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CONTENTS.

ILLUSTRATED ARTICLES:	PAGE.
Measuring Instruments at the Philadelphia Exhibition	43
Kauffer's Electric Batteries	45
The Tower System of Electric Lighting	46
EDITORIAL PARAGRAPHS	41
MISCELLANEOUS:	
Progress of Electric Lighting in New York City	42
Heating by Electricity	42
A Simple Self-Registering Electric Meter Wanted	42
The Gold & Stock Tax Case	45
Central and South American Telegraphs	46
Long Spans with Silicious Bronze Wires	46
An Undulatory Current in a Closed Circuit Not Necessary for Telephonic Transmission	46

MISCELLANEOUS:	PAGE.
A Thrilling Mexican Tale	46
The Bell Patent Null and Void in Canada	47
The Resistance of Carbon Contacts	48
Electric Light Carbon Interests	48
A New Engine	48
DEPARTMENTS:	
Western Notes	48
The Telegraph	49
The Telephone	49
The Electric Light	49
Miscellaneous Notes	49
Applications of Power	50
Stock Quotations	50
Our Illustrated Record of Electric Patents	50
Contents of Preceding Numbers	viii

New Advertisements.

The Brooklyn Electric Construction Co.—Electric Apparatus ... i
Waite & Bartlett—Experimental Models ... iv
"Spark"—Position Wanted ... v
J. S. & M. Peckham—Mica ... v
Meadowcroft & Guyon—Electric Scarf Pins ... vi
REARRANGED ADVERTISEMENTS.
Ball Engine Co.—Engines ... v

Vol. V. NEW YORK, JAN. 31, 1885. No. 5.

Handsomely bound volumes of THE ELECTRICAL WORLD *for* 1884 *are now ready, and will be sent, charges prepaid, to any address on receipt of* $5.00.

WE show to-day, by figures carefully compiled, that there are now over 26,000 incandescent lamps burning regularly in New York, and that wires have been run for at least 6,000 more. There are also more than 2,700 arc lamps in use. Does any other great city make an equal use of electricity for illuminating purposes?

PRINCE BISMARCK has not hesitated to avow his dislike of the telegraph, and he is enough a lover of old times and things to despise railways. He would find Calhoun County, Illinois, a region after his own heart. There is not a mile of track, not a telegraph office and not a bank in the county, although the population is 8,000.

WE have obtained, and publish in full in this issue, the text of the decision just rendered in Canada declaring the Bell patent null and void there. The decision appears to be without appeal, and must therefore have considerable influence upon the future of telephony and telephonic interests in the Dominion. It is to be borne in mind, however, that several thousand Bell instruments are already in use in Canada, and that the very nature of the business requires that there should only be one exchange or one service in any centre of population.

PRESIDENT SCRYMSER'S report of the operations of the Central & South American Telegraph Company during 1884, given by us elsewhere, is an encouraging document. The business is evidently capable of developing at a high rate, and of paying a good interest on the investment in due time. It would appear that the service gives satisfaction to the customers. If we may judge from the tone of the West Indian papers we receive, the service rendered in the West Indies by the English cable company operating there is of a very unsatisfactory nature. Perhaps improvement might be effected in transferring the West Indian cables to American control.

THE Cleveland electro-motor tests furnish another proof of the ease with which electricity can be applied to railways and car lines. The trial on the Garden street line in that city during the winter has been satisfactory, and the East Cleveland Street Railway Company are now about to apply the Knight-Bentley system to a long stretch of their track, for regular service. Meantime, the New York elevated railroad people and others over whose heads devout prayers are breathed daily by electricians eager for their conversion, persist with obduracy in the errors of their old methods of locomotion. Our motor friends must possess their souls in patience a little while longer.

THE lively interest felt in the electro-motor experiments on the elevated roads of this city is exemplified by the application of Mr. Magnus Volk, the English electrician, to be admitted to the association of inventors and owners of electro-motor patents. We have from time to time published accounts of Mr. Volk's successful and profitable little electric road along the seashore at Brighton, the fashionable resort on the south coast of England. Of course Mr. Volk, after his own demonstration of practicability there, "is confident that the electric motor can be applied to the elevated railroad system with safety and profit" here, but just what good he expects to derive from entering the great "association of inventors and owners" is not very plain.

AT last the telephone is being rightly appreciated. A man out in Nebraska has been so eager to get an instrument that when the Nebraska Telephone Company refused to let him have one on the usual terms, he carried the matter to the law courts; and he has now obtained a verdict from the Supreme Court of the State. The point of the decision, of course, is that the position of a telephone company is like that of a telegraph or other corporation, and it must treat on an equal footing all applicants for the service which the corporation was chartered to give. The principle is good, but its application becomes difficult in such a triangular dispute as that now going on between the "ticker" companies, the commercial exchanges, and the "bucket shops."

GOOD electrical libraries are by no means too plentiful, and additions to the number are welcome. We are glad to note that at the annual meeting of the Franklin Institute on Jan. 22, Col. C. H. Banes, who will be pleasantly remembered by many electrical visitors to Philadelphia, presented to the Institute formally, as a memento of the Exhibition, the fine electrical library that was collected by himself and the managers and that was on view in the Exhibition annex. It is to be called the Memorial Library. There are nearly 3,500 volumes in it, and many of them are, as we know from personal examination of them, and as the catalogue will prove, of a very valuable character. Some of them justify a breaking of the tenth commandment.

IN Canada there is said to be a recrudescence of the postal telegraph fever, and it is stated that a strong effort is being made to induce the government of the Dominion either to buy out the existing interests or to create a new additional service of its own. The lines of the Dominion and Montreal telegraph companies are now leased and operated by the Great Northwestern Telegraph Company. Montreal shares are quoted at 113½, and Dominion at 80, bearing a guaranteed dividend of 8 and 6 per cent., respectively. The guarantee is terminable upon 12 months' notice, and the government is asked to take the necessary steps to secure its termination at the earliest possible moment. We do not believe in any great public anxiety on the subject, but we can, without great effort, believe in a desire of the companies to sell out at what they consider a fair valuation on the above basis.

IN a fit of economy, the City Council of Newport, R. I., voted, last week, to abandon the electric light for street illumination and to fall back upon the use of gas and naphtha. At least, the Council says it was influenced by economy in taking this retrograde step, but nine-tenths of the community do not want this so-called saving and are indignant at it. Petitions have been circulated for signature protesting against the action of the Council, and we may hope therefore that the beautiful watering place will continue as in years past to enhance its comeliness by a generous display of arc lamps. This little incident shows how strongly people have become attached to the new method of street illumination.

THE secret is now out in regard to the attempt to abandon the electric light as mentioned above. A special dispatch from Newport says: "Public opinion has been heard from in the matter of the street electric light. The committee on gas and lamps that has had the matter in charge intended to settle the question, as far as electric lights were concerned, and, to carry out the vote of the city council, have held a meeting and were confronted with a formidable list of petitioners praying for their retention. The committee wisely decided to refer the matter to the city council again, and this virtually decides that the street electric light will be retained. The city council has been unmercifully censured for its action in the premises, as the taxpayers, by a popular vote two years ago, decided by a large majority in favor of electric lights. But for the uprising of the taxpayers the scheme, which was kept secret until the vote was taken, would have been a success. Even the stockholders of the gas company regret that such a questionable plan was adopted, as it will tend to hurt that rich corporation." The "regret" of the rich gas corporation at the exposure of the little game is most touching.

To the dog-in-the-manger policy and attitude of the government officials in control of the service, is usually attributed the slowness with which the telephone is adopted by the English public. But there is reason to believe that the stolid conservatism of a large section of that public is equally responsible for obstruction. A list has been published of some of the objections made when "right of way" was asked for by the linemen of the telephone companies. One householder said that "being an invalid," he was "compelled to refuse." Equally inconsequent is the reply of another, a man, who said: "Wife has a great terror of lightning." A third person said he would give consent, were it not that his roof was "too old and dangerous." The funniest reason of all is this: "Would willingly permit the fixture being made, but was informed by a friend that the language used by the speakers was so foul that she was compelled to remove her children's bedroom to a lower room until the fixture was removed."

RELUCTANCE on the part of competing companies to tell what amount of business they are doing would be natural, but we are enabled by the ready courtesy of the companies now engaged in electric lighting operations in New York City, to show a most encouraging state of things here. The shallow criticism has often been made that as soon as the parent concerns owning the various systems had sold all their rights and territory to "gullible" people, there would be an end to the electric lighting business. The very contrary appears to be the case, and now that the country has been surveyed and occupied by the owners and lessees of the various rival systems, the industry is going ahead as it never went before. Mr. Preece, as an impartial and even severe critic, bore flattering testimony recently to the rapid rate of growth, and we think that our detailed figures given to-day furnish confirmation also of the most encouraging character. The observation is appropriate that in New York City two or three systems have an overwhelming superiority. They were the first to come and have used the opportunities of early occupation of the field. Other well-known systems for which, nevertheless, extensive patronage might have been found, have been pushed elsewhere. The result is that while some lights abound in New York, others are in the majority on Long Island or in New England, and that others again are known chiefly through the West, yet others predominating on the Pacific slope. How long this condition of things will last is an interesting problem.

OUR review of electric lighting progress in this city shows that at least a score of the largest new buildings have been equipped with incandescent plants during the past year. New York is to be a city of huge buildings, a congeries of vast social and commercial palaces; and the isolated incandescent plant is strikingly adapted to the present and future needs of such an architectural régime. We see no great objection to "combination fixtures," and the laying on of gas and electric light, for those who wish to have both illuminants on tap. The compromise is no longer based on a feeling of insecurity as regards the latest comer, but has reference to economy and the wishes of successive tenants. When gas was first introduced, great care was taken to be secure against deprivation of light, and to this day most houses fitted for gas have oil lamps or candles for occasional use. It was only to be expected that the electric light should at first be patronized sparingly, suspiciously and with provision for other means of lighting in case it should fail. Now, the sense of insecurity and uncertainty has died out, one of impatient desire has succeeded it, and life is made a burden to the electrician by the inquiry thrust at him fifty times a day as to how soon ordinary folk will be able to "burn electricity" instead of gas. New Yorkers say, too, that the gas goes from bad to worse, and that lower gas rates do not mean smaller gas bills.

Progress of Electric Lighting in New York City.

In our review of electrical events and progress during the year 1884, the general statement was made in regard to the subject of electric lighting that, both scientifically and commercially, the light has advanced. The first will be readily admitted by all, but there are not a few, and especially those who have another interest at stake, who boldly claim that no commercial progress has been made. We propose, therefore, to give a few figures which will set these doubters a-thinking, and will, we believe, prove beyond cavil that the electric light has come to stay and to spread.

As it would be almost impossible to give accurate details regarding the entire extent of the increase of electric lighting in this country, we have confined ourselves to a definite case, of which we are enabled to speak with accuracy, and have therefore selected the city of New York as an example.

Beginning with incandescent lighting we find that the increase is a most gratifying one.

Looking at the number of Edison lamps burning a year ago and further back, we get the following figures, which apply only to the central station established in 1882:

	Number of lamps.	Number of consumers.
Jan. 1, 1883	3,056	229
" 1, 1884	10,316	485
" 1, 1885	12,875	590

This station has now reached the limit of its full capacity and is unable to supply the demand for its light, 100 applications being on file which the company is compelled to refuse for the present. Notwithstanding the fact that the price of gas has fallen from $2.25 to $1.75 per thousand, only four customers have been lost, as the Edison Company adheres to its old charge of $2.25 per equivalent of 1,000 cubic feet of gas.

Marked as this increase has been in central station lighting, that in isolated plants is proportionally greater still. Whereas, on Jan. 1, 1884, there were only about 1,200 lamps burning in isolated installations, Jan. 1, 1885, saw over 6,000 lamps in actual operation and buildings wired for 10,400 more. Among the more important installations put in operation by the Edison Company during the last year may be mentioned the following:

	Number of lamps.
Murray Hill hotel	900
McKee Rankin's theatre	600
Eden Musée	300
Koster & Bial's concert garden	258
Second Avenue car stables	200
Carleton Club house	200
Park & Tilford's stores	200
Columbia College	280
Gorham Manufacturing Co. building	225
Dakota apartment house and adjoining buildings	600

The last-mentioned buildings—known as the Clarke estate—although burning at present only 600 lamps, have been wired for 11,000, and dynamos will be added as soon as needed. Most of the apartments are still unoccupied, as they were but lately completed. In taking the figure at 600, therefore, we are treating the subject in the most conservative manner, so as to leave no chance for discussion. Since Jan. 1 of this year, the Edison Company has received orders for lighting the New York Cotton Exchange with 1,800 lamps, the Osborne apartments with 1,500 lamps, and for several minor installations.

Summing up the figures for this company, we have the following as the number of lights both from central station and isolated plants:

	Number of lamps.
Jan. 1, 1884	11,516
" 1, 1885	18,875
" 1, 1885 wired for	29,275

Although the Edison Company has only one central station at present, there is in contemplation the erection of another of far greater capacity, farther up town, which will be equal to the work of either 20,000 or 40,000 lamps.

The United States Illuminating Company, the local licensee of the United States Electric Lighting Company also shows a marked progress during the past few years of its existence. Its first permanent station at 206 and 208 Fulton street was completed in June, 1882, with a capacity of 300 horse-power. Two additional stations were completed soon afterward, one at 101 and 103 East 44th street, with 600 horse-power capacity, and the other at 36 Stanton street, with 1,200 horse-power—this latter being the largest and best equipped electric light station yet erected. These stations have been in successful operation since their completion, and they will all soon be running up to their full capacity.

This company lights with the arc and incandescent systems of Mr. Weston. Taking up the incandescent first, we find that on Jan. 1, 1884, it was running 500 lamps and on Jan. 1, 1885, 2,000 lamps from central stations. Isolated installations were also put in, so that while Jan. 1, 1884, showed 1,200 lamps in operation, Jan. 1, 1885, gives about 5,100. Several important buildings have been lighted during the year among them the following:

	Number of lamps.
Chelsea apartments	1,800
Washington building	900
New York court house and post office	115
" " " " to be wired for	1,200
F. W. Stillman	500
Frank Leslie's publishing house	200

The arc-lighting business of this company has also increased considerably during the year—another proof that in its own particular field arc lighting is without a rival. Comparing the figures in the same way as heretofore we get for Jan. 1, 1884, about 650 arc lights and Jan. 1, 1885, about 1,000 arc lights. Of this number, the city alone takes 300, leaving the rest to private consumers. The company has now in use about 240 miles of circuits covering nearly all the prominent avenues, streets and squares. It lights the city below Fourteenth street, its circuits comprising Broadway, from the Battery to Twelfth street; South street, from the Battery to Grand street; West street, from the Battery to West Eleventh street, and Washington and Tompkins squares.

Among the systems represented in New York City, the Brush ranks with the first and highest. The local licensee, the Brush Illuminating Company, has now two stations in operation—one in Elizabeth street, and the other in Twenty-fifth street, near Sixth avenue. It is at present furnishing 1,386 arc lights, as against 1,104 at the same time last year, showing a gain on a previous large business. It is now operating 50 circuits, an increase of 9 during the year, the shortest being 4,850 feet in length and the longest 27,000 feet.

It furnishes 347 lights to the city, all above Fourteenth street. Its territory includes Madison and Union squares, each illuminated with six powerful Brush lamps, on the tops of immense, lofty poles, also Broadway, Park avenue, Fourth, Fifth, Seventh avenues, and a number of other streets.

The Sawyer-Man Illuminating Company has now five installations running in this city, nearly all put in during the year. The most important is that in the Mutual Life Insurance Company's building, with a capacity of 2,000 lamps. The remaining plants will foot up about 600, so that 2,600 would represent the number of lamps operated on this system in New York.

In addition to the systems above mentioned a number of others are represented in New York City, among them the Hochhausen of the Excelsior Electric Company. They have more than 100 arc lights running in the city and also an incandescent plant in the Produce Exchange and the Safe Deposit Vaults, these giving thorough satisfaction. The Fuller Electric Company also has several plants of arc lights in operation, numbering about 70 lamps; among their installations being Lord & Taylor's two stores, with 38 lamps, and the Old Dominion Steamship Company with 16 lamps.

A number of other companies are also represented, but the number of their lamps would probably not exceed 100, all told.

One of the most interesting statistical exhibits, in this connection, is the increased number of arc lamps with which the city now lights its streets. On Jan. 1, 1884, there were only 128 arc lamps used for that purpose, whereas to-day there are no fewer than 647, which are operated by the two companies mentioned above. Among the more important streets, we have:

	Number of lamps.
Broadway	99
South street	64
West street	50
Fourteenth street	40
Twenty-third street	34
Thirty-fourth street	36
Forty-second street	35
Fifty-ninth street	22
Bleecker street	32
Fourth avenue	16
Fifth avenue	48
Seventh avenue	43
Park avenue	9
East Broadway	20
Among the parks and squares we have:	
Battery park	20
City Hall park	10
Tompkins square	16
Washington square	15
Gansevoort market	13
Union square (6 double lamps on pole)	12
Madison square (6 double lamps on pole)	12

Here we have nearly 35 miles of streets lighted by electricity, and when we consider that the total mileage of illuminated streets in New York is about 440 miles, the showing is a very creditable one. The great satisfaction, thus far, which the electric light has given is evinced by the numerous requests made to the authorities to introduce it into new localities.

A résumé of these figures shows that during one year the number of incandescent lamps burning increased over 100 per cent., while the arc lights added nearly 50 per cent to their number. These figures, which are obtained from the proper and trustworthy sources, convince us at a glance that the field to be occupied has but barely been touched. The progress is so steady and well-defined that we feel safe in asserting that in a year hence we shall be able to note an equal, if not a greater annual progress.

A Large Territory to Look After.—The Board of Directors of the Erie Telegraph and Telephone Company recently elected Mr. J. P. McKinstry general superintendent of their territory, consisting of Minnesota, Dakota, Arkansas and Texas. Mr. McKinstry will probably have his headquarters in Cleveland and retain general supervision over this territory with Mr. C. P. Wainman as superintendent over the local company. Mr. Wainman has been connected with the company since the first telephone was put in in 1879, and is well known in this city. Mr. McKinstry's new and immense field of operation will keep him away from the city more or less, but he will still be at home in Cleveland. He was with the Western Union Company for twenty years, leaving in 1879 with a number of other bright and active spirits to venture in the telephone field.

Heating by Electricity.

One of the latest applications of electricity is that of car-heating. Recently Mr. de Meritens showed an apparatus at his works which is designed to effect the above purpose. The current was generated by a Gramme machine and the heat distributed by long metallic muffles in the shape of flat cylinders, resembling the warming bottles in present use. A special apparatus serves to concentrate the heat and to spread it equally over the whole length of the muffle, so that it radiates evenly.

In a letter to the London scientific papers, Mr. J. S. Sellon, writing on this subject, remarks that heating by electricity has not as yet attracted the attention which so important a subject would seen to merit, and that since 1883 he has successfully warmed some of the smaller rooms of his house with a very simple apparatus of his own invention. He says, also, "When once the electric current is furnished to railway carriages for lighting purposes, which cannot be long delayed, this will doubtless prove to be a very convenient and cheap method for heating them. If the arrangement is fitted to permanent receptacles containing salts, such as acetate of soda, the heating of carriages can be carried out with still greater facility and convenience, and at a very low cost."

While we are always glad to note any improvement and progress in the application of electricity, we must nevertheless take exception to one item in the above statement. We readily admit the convenience and facility of heating by electricity, but we doubt very much whether the undertaking will prove a *cheap* method.

With due respect to Mr. Sellon's experience as an electrician, we would point out the enormous loss which attends the conversion of the heat contained in steam as compared with that given out by the electric radiators. Assuming steam as the motive power we need only to refer to the wastefulness of the steam engine, which rejects in the exhaust many times the heat which is actually converted into work; adding to this the further loss in converting mechanical into electrical energy, which, though small as compared with the former, is an appreciable one, we must confess ourselves unable to see in what manner this mode of heating will prove cheaper than that of heating directly by steam from the boiler, or, better still, by the exhaust steam of an engine—methods by which nearly the entire heat contained in the steam can be utilized. Thus, it is evident that where cost is of little or no consideration, no more desirable method of heating could be adopted; but, where these conditions do not obtain, electric heating might meet with serious obstacles. However, with a cheap water-power and good turbines, the above conditions would be materially changed, so that the item of cheapness might be more nearly realized. Unfortunately, these conditions are rare, so that any extended application on this plan appears out of the question, at the present stage of progress.

A Simple Self-Registering Electric Meter Wanted.

The advent of a new undertaking, as a rule, creates a demand for details which help to put it upon a firm basis, and which may in some cases even determine the success or failure of the whole enterprise. This fact was again exemplified when incandescent lighting from central stations was first established. Among the most important of the many details was the devising of a means for determining the amount of light used by each consumer, and the most natural way to obtain this was to measure the current supplied. Thus some form of current meter became a necessity, and Mr. Edison and others set about to supply the want. This has resulted in the production of various kinds of meters, which may be roughly classed as self-registering and non-registering. The principles involved in their construction differ, but that which has come into most prominent use depends for its action upon the deposition of metals by electrolysis. This method is scientifically exact and permits of easy application, and we thus find it in use on the Edison system as operated in this city. In the meters here employed a part of the main current is shunted into a cell containing two pieces of zinc immersed in sulphate of zinc, where it dissolves metal from the one and deposits it upon the other. At the end of each month the plates are gathered, brought to the main office, and the change of weight of the plates determined, which forms the basis upon which the charges are made. Although, as stated above, this meter is scientifically accurate, it nevertheless possesses the disadvantage of being beyond the control of the consumer and entirely in the hands of the lighting company. What is wanted in this direction, therefore, to satisfy the ever suspicious consumer, is a simple meter which will show to the consumer at any time the amount of light used by him, or in other words, a self-registering meter. A number of these are extant, some of them of highly ingenious construction, but none of them have gone beyond the laboratory, so that in practical every-day use we find no registering electric meter. There has, however, been recently brought out in England a self-recording meter which embraces some novel points, and would appear to be an easy way out of the difficulty. In its simplest form it consists of a hydrometric float carrying an electrode, and graduated to indicate the amount of current passed, by the electro-deposition of metals; the other electrode is attached to the containing jar. The application of this principle of the hydrostatic

float, though not entirely new in this connection, is nevertheless a very convenient one, and one which lacks nothing as regards accuracy. The different forms which might be given to such an instrument we leave to the imagination of our readers, who might, with profit to themselves, devise a means for applying the above principle.

Measuring Instruments at the Philadelphia Exhibition.

BY EDWARD P. THOMPSON, M. E.

(*Concluded from page 209, Vol. IV.*)

Electrometers.—In the study of the distances between the planets, a long time elapsed before the *absolute* distances were obtained, although for many years previously the *relative* distances had been calculated; so in electricity, electroscopes of two or three types were devised whereby an electrical charge could be detected; next in order came the electrometer, which could be used not only for detecting the presence but also for measuring the relative amounts of two or more charges; and at present we have absolute electrometers to measure not only the relative amounts, but also directly the absolute quantity of charge.

It may be noticed then that there are two ways of measuring distance, weight, electrical charge, and all the other mathematical quantities, namely, by comparing them with one standard but unknown unit, and by measuring directly their absolute value. The astronomers knowing how many times further from the sun Jupiter was than the earth, knew the absolute distance of the former just as soon as the absolute distance of the latter was determined somewhat accurately by the help of the transit of Venus. The relative distance were known many years before the absolute distances.

Electrometers at the present day are of two classes, comparative and absolute, in their measurements. Since

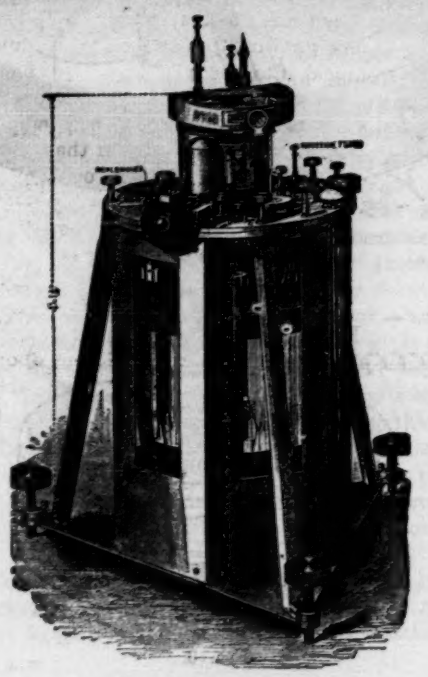


FIG. 3.

these instruments are apparently rather complicated in their construction, and as to understand their *modus operandi* and principles of construction is of more importance than to understand their mechanical construction, it is advisable first to look into some of the fundamental principles and facts upon which their existence now rests.

A metal plunged into a conducting liquid becomes charged with electricity, while the liquid also becomes charged with an equal amount of electricity of the opposite kind or in opposite directions. Two pieces of dissimilar materials brought into contact, and especially if rubbed or pressed upon each other, become charged in the same manner. Certain minerals, when heated, become charged as to different portions of the surface with equal and opposite kinds of electrical energy; while, when two dissimilar metals are placed in a conducting liquid, there is no charge between the liquid and either or both plates, but there is between the two metals.

The facts or experiments illustrating these principles are best appreciated with an electroscope, which, in its simplest form, consists of a pith ball suspended by a fine thread of silk. Bring one of the metals when charged near the ball and it is at once attracted, and when fully charged with the same kind of electricity it will rebound according to the law that like electricities repel and unlike attract. One kind of metal and differently-sized pieces of metals would be capable, when charged, of attracting the same pith ball through greater angles, and similarly would repel to different degrees: the amount of charge depending upon the area of the surface of the electrified bodies upon the material, whether produced by friction or chemical action, upon the dampness of the air, and upon other influences than air which would instantly begin to weaken the charge.

When these two kinds of electricity exist, the force existing between them is called "difference of potential," which term has become technical; but there is no more equivalency between difference of potential and electro motive force than there is between the latter and current, and not even so much; for there may be, and always is, a current where there is an electromotive force, while there may be difference of potential without electromotive force, in exactly the same way in which there may be pressure without velocity in a body of water. Let there be two reservoirs of water at different levels, and connected by a pipe, and let the pipe be closed. The higher water presses against the lower water, but there is no motion, and, therefore, no velocity. Let the pipe be opened, and then there

FIG. 1.

is a velocity of water from the higher to the lower reservoir. Pressure and velocity are, therefore, seen to be analogous respectively to difference of potential and electromotive force. To measure the latter is the object of the voltameter; to measure the former is the object of the electrometer.

A difference of potential is exhibited by attractions and repulsions of comparatively small magnitude, and needs for its measurement the weakest mechanical resistances known. The kinds of mechanical resistances which may be or have been used are those offered by a weight, a spring, twisting or bending a fibre of silk, compressing or stretching an elastic substance, or swinging a pendulum. Coulomb suspended a pith ball by a fibre of silk, the ball being on the end of a horizontal needle connected at its centre to the fibre and counterbalanced on the other end by a small weight. The natural position of the fibre kept the needle quiet. Another pith ball was fixed near the former, so that when both were under a difference of potential they would repel each other. The force of repulsion caused the fibre to twist. By repeated experiments and reversals of experiments and by experiments under various conditions, Coulomb established the law that two small bodies electrified by like electricities repel each other with a force inversely proportional to the squares of the distances between their centres. Ever since this law was discovered, numerous electrometers were constructed in such a manner that measuring this repelling force would be identical with measuring the difference of potential.

The accompanying cuts are taken from instruments exhibited by James W. Queen & Co., of Philadelphia. Fig. 1 is the Peltier electrometer; Fig. 2 is a quadrant electrometer constructed for lecture experiments and intended to illustrate the principle discovered by Sir William Thomson, and shows the difference of potential of a single cell; Fig. 3 is a Thomson quadrant electrometer; Fig. 4 is a Thomson absolute electrometer; Fig. 5 a large new Thomson quadrant electrometer, and Fig. 6 an inside view of a portion of Fig. 5. Figs. 7 and 8 repre-

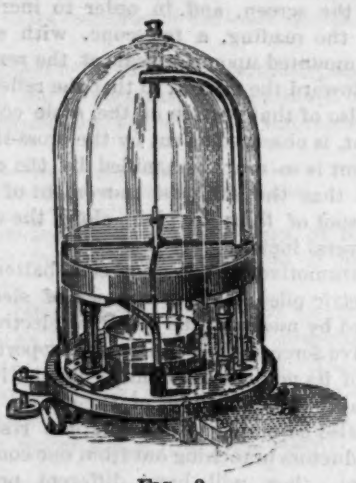


FIG. 2.

sent Edelmann's modified form of Thomson's quadrant electrometer.

The Peltier electrometer (Fig. 1), but more properly an electroscope, on account of its inaccuracy in measuring or comparing, and principally serving to detect a difference of potentials, consists of a graduated circle, the use of which aids to give a rough idea as to the amount of charge. From the centre rises a support which terminates in a knob to receive a charge. The charge is transported to the two little knobs on the end of the fixed cross-piece, just above the circle. Supported on a pivot is a very small permanent magnet (not seen), and provided with a pointer of aluminum, which hangs just so that the earth's magnetism brings its ends to rest near the fixed cross-piece. A charge communicated to the large knob on the top of the apparatus causes the magnet and pointer to be repelled through one or more degrees, according somewhat to the amount of difference of potential. Where it is is desired to illustrate the principles in a lecture or to make rough measurements in the laboratory, this instrument and that in Fig. 2, being of simple construction and easy to keep in good order, are useful and convenient. The principles of Fig. 2 are perhaps best understood in connection with a description of the instrument. On the bottom is located a Leyden jar which serves simply as an independent reservoir of a statical charge. It consists of a shallow glass vessel partly filled with sulphuric acid and lined on the bottom and around the sides with tin foil. The acid serves not only to contain one kind of electricity, but also absorbs all the moisture under the glass shade, thus preventing rust, but especially preventing a carrying away of the statical charge by the moisture. The acid must be examined from time to time, as it very often overflows by capillary attraction and by taking up so much moisture. A needle of aluminum is supported by a double fibre of silk and it is highly charged, and in order to replace the electricity, carried away by surrounding objects and any trace of moisture, it is connected with the Leyden jar located as described. The needle is not seen in the cut, because it is so suspended as to be contained in a box made of four quadrants, insulated each from the adjacent quadrants but connected electrically to those diagonally opposite. One pair is connected metallically with the earth, while the other is adapted to be connected with the surface whose potentials are to be measured or compared.

Let the needle be charged and also the jar; let the other connections be made; then the direction of deflection of

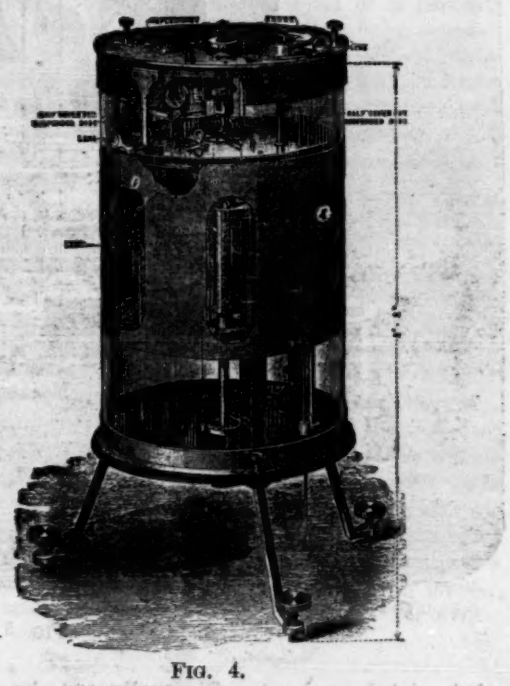


FIG. 4.

the needle immediately indicates whether the charge on any given surface is positive or negative; for it is evident that if it is positive, the ends of the needle will be repelled by those quadrants connected to the charge to be measured, while if it is negative they will be attracted and the deflection will be in the opposite direction.

Some additional facts, in reference to the instruments, may be given. The electrical connection between the needle of deflection and the acid below is made by a platinum wire attached to the needle and attached in such a manner as to dip into the acid. Three metal rods project from beneath the base of the instrument, two of which are connected respectively to the two pairs of quadrants, and the third is connected to the needle and Leyden jar when it is desired to charge them with electricity; the reason why the supporting double fibre is made of two fibres about 1-20 in. apart is to provide a thread which, when put under torsion, will accurately obey the law of Coulomb and will always return to the same position. The quadrants are made in the shape of sections of a box, so that the needle will be acted upon more uniformly from all sides; sometimes the needle requires more accurate adjustment than the double fibre will give it automatically, and for this purpose the milled head at the top of the instrument is provided; a wire cage is put over the whole instrument, when in use, to protect it from the influence of outside objects, the cage being connected to earth. The instrument may be employed for determining a potential by the zero method, by letting one pair of quadrants be connected to one potential, and the other pair to another potential, which, if equal to the former, will cause the needle to stand at zero, or by properly adjusting one of the electrified bodies, the needle may be brought to zero. The best quadrant electrometers are those shown by Figs. 3, 5 and 6. They are constructed by some of the best and most skilled mechanics in the world, and are imported, and were exhibited by James W. Queen & Co., as before mentioned. As shown in the cuts, these

two electrometers are of different construction and appearance, but they act on the same principle of the employment of quadrants, as the name indicates. Figs. 5 and 6 will first be explained. The most essential feature is the mirror *M*, which is suspended from the needle represented by a dotted line *E F*, and suspended in the box composed

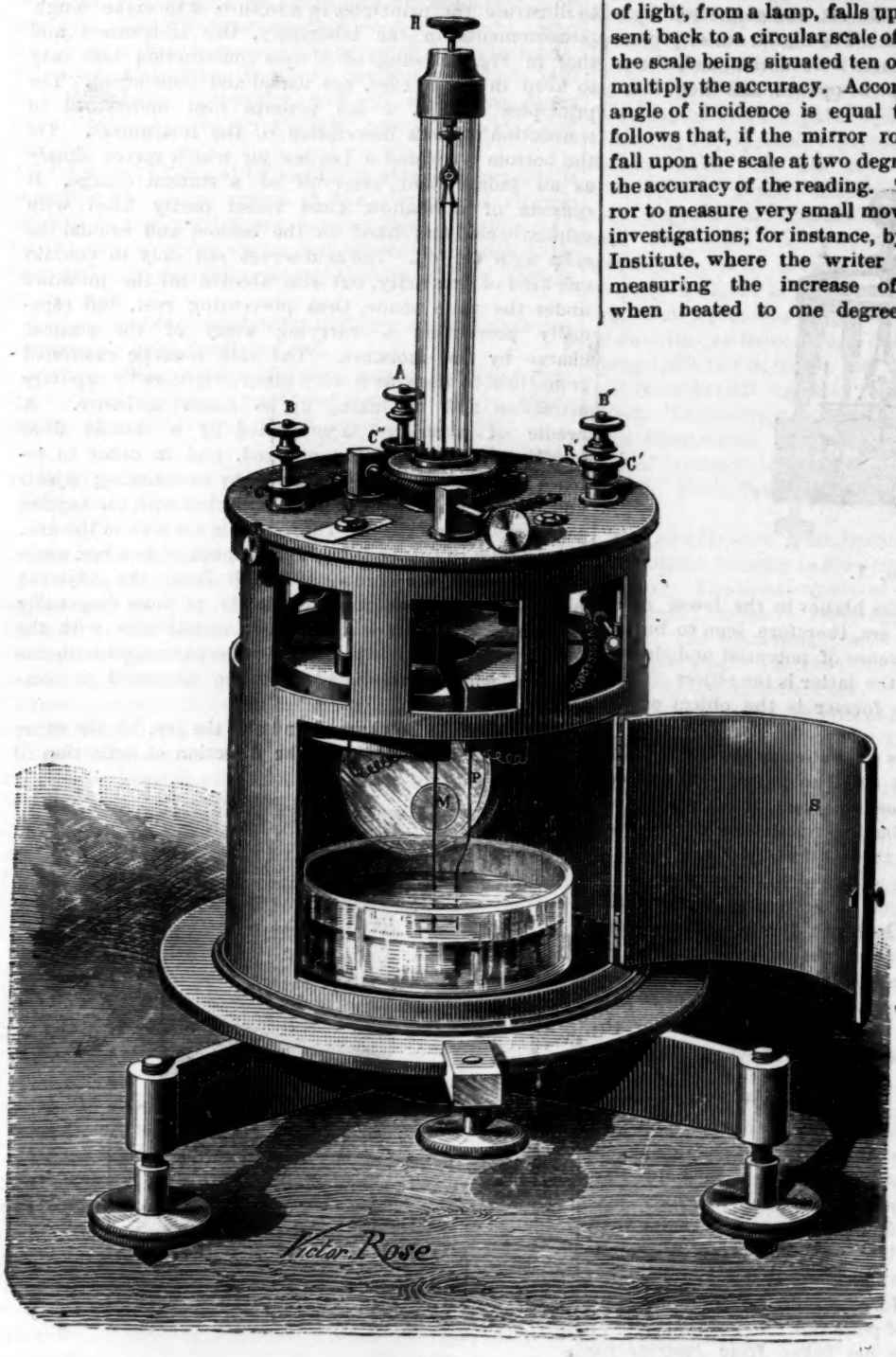


FIG. 5.

of insulated quadrants. Diagonally opposite quadrants are represented as being connected electrically by spiral wires *A* and *B*, and each set of quadrants may be communicated, the one with earth and the other with any

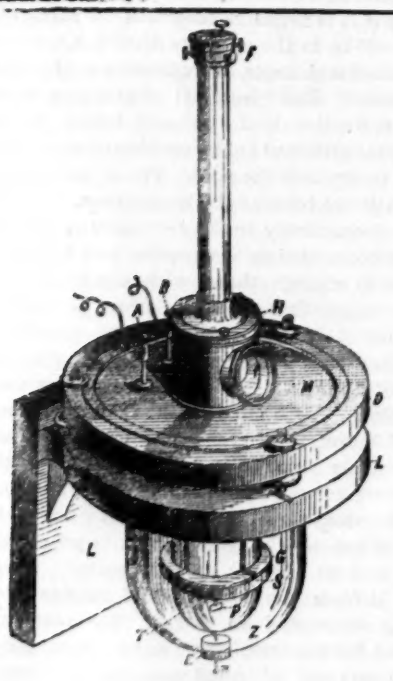


FIG. 7.

electrified body, or both with electrified bodies at the same or at different potentials, by means of the wires as shown. The needle is suspended as usual by a bifilar fibre, and the ligature which supports the mirror terminates in the sulphuric acid in the Leyden jar, the same as in the small electrometer described above. Other explanation that might be given of the construction of the instrument would relate to the outside case, the binding posts, the thumb screw *H* for adjusting the needle, the leveling screw-legs at the base, and the wire connecting with the Leyden jar from the outside source of electricity. The least deflection of the needle will also rotate the mirrror through a greater or less angle, so that if a ray of light, from a lamp, falls upon it, the reflected ray will be sent back to a circular scale of which the mirror is a centre, the scale being situated ten or twelve feet distant so as to multiply the accuracy. According to the principle that the angle of incidence is equal to the angle of reflection, it follows that, if the mirror rotate one degree, the ray will fall upon the scale at two degrees, thereby also multiplying the accuracy of the reading. This idea of employing a mirror to measure very small movements is employed in other investigations; for instance, by Prof. Mayer, of the Stevens Institute, where the writer several years ago assisted in measuring the increase of length of a brass bar when heated to one degree above the freezing point, the bar being only three feet long to start with. This method of measuring any small movement is the foundation of the receiving apparatus of the Atlantic cable. The least movement of the mirror makes visible a spot of light dancing along the scale. The ray is generally obtained from a lamp located behind a screen in which there is a rectangular slit or circular hole. The scale is a portion of the screen, and, in order to increase the efficiency of the reading, a telescope, with spider cross-threads, is mounted upon the scale at the zero mark, and is pointed toward the mirror, so that the reflection of the spot, and also of that portion of the scale containing the spot of light, is observed as cut by the cross-threads. The measurement is so much magnified by the combined arrangement that the slightest movement of the mirrors causes the spot of light to glide along the scale to a distance of several inches.

The electromotive forces of a cell, battery, dynamo, thermo-electric piles, or other sources of electricity, may be compared by means of the quadrant electrometer. The electromotive force of the source is proportional to the potentials of its poles, so that the electromotive forces are proportional to the deflections of the needle. The instrument may also be employed to compare resistances. If several conductors branching out from one conductor carry one current, they will have different protentials at any two given points and these potentials vary as the resistances. The resistance of the branch conductors to be compared are joined at their ends and the current switched on. The two points of each conductor whose resistance is to be compared, are successively connected up with the instrument, and the deflection is noted in each case. The ratio of the deflections gives that also of the resistances, the necessary precautions being to have a constant current or else a sensitive rheostat to maintain it constant: to see that the needle is adjusted so that it will lie in a horizontal plane and longitudinally in a diameter separating the quadrants; to have enough acid in the Leyden jar to completely cover the "fly" suspended from the needle; and not use the instrument until a considerable time has elapsed after the jar has been charged, *i. e.*, not until the needle becomes quiet.

To measure the absolute potential, Sir William Thomson invented and had constructed an absolute electrometer, shown in Fig. 4. It consists essentially of two horizontal plates. In the centre of the upper one is a hole in which is suspended a light disc, by means of three or more springs made very delicate and of the form of ordinary carriage springs. The disc is provided with a fork across whose prongs is stretched a hair from a black-and-tan terrier, and the disc is so adjusted by a micrometer screw that, when the hair is sighted between the dots, it hangs so as to exactly fill the aperture in the plate, making thus one continuous surface with the plate. The plate and the disc are in electrical communication through the medium of the supporting springs. The lower of the two horizontal parallel plates is movable up and down, and is adjustable at any position by means of a micrometer screw. When it is desired to use the instrument, the disc is adjusted so as to be a little above the level of the plate. The two plates and disc are then all electrified by connecting them up respectively with the two poles whose

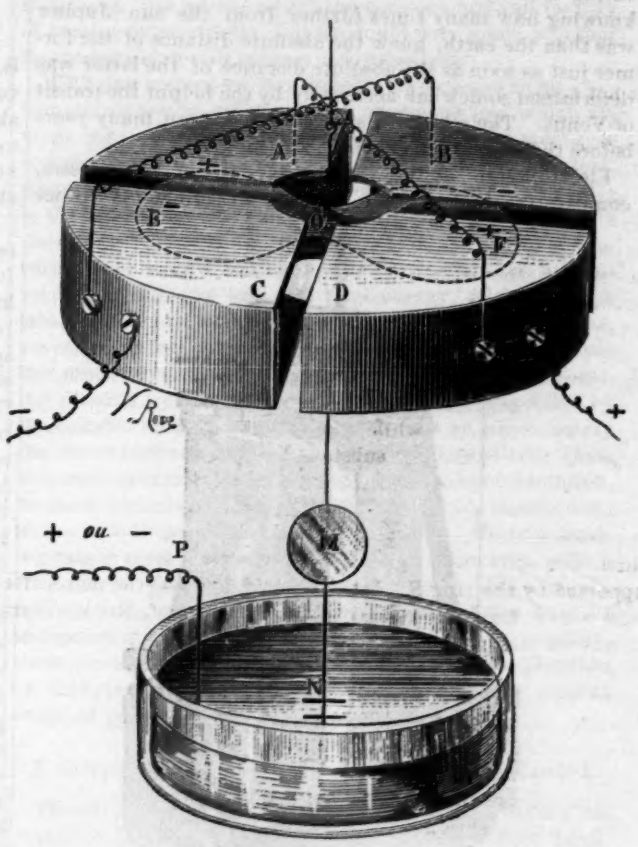


FIG. 6.

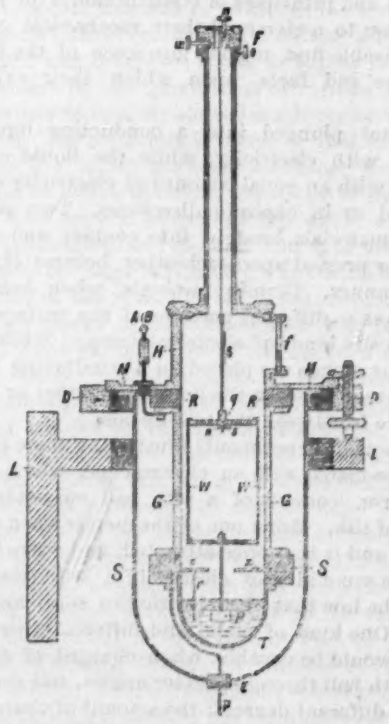


FIG. 8.

potentials are to be measured, and the lower plate is adjusted by the micrometer screw until the hair appears midway between the two dots. This condition of things proves that, at the distance apart of the plates, the attraction exactly counterbalances the force of the springs attached to the disc. The data for calculation are thus established; for there are given the distance between the

plates, the surface and weight of the suspended disc and the force of the springs.

Let the disc be called *a*, the spring *b*, the plate surrounding the disc *c*, the lower plate *d*; then will the quantity of electricity per unit of area on the plate *a* be equal to $\frac{f}{4\pi e}$, where *f* equals the *total* potential on the plate and where *e* is the distance between the plates *c* and *d*. Over the surfaces of the plates, the charges are equally distributed and of opposite sign. The total force with which the plate *c* is attracted by *d* will be equal to $\frac{f^2 M}{8\pi e^2}$ where *M* is the *total* area of the plate in square centimeters. Reducing this equation, there is obtained

$$f = e\sqrt{\frac{8\pi g}{M}},$$

where *g* equals the force of the spring. Substitute in this equation *e*, the value of the distance between the plates, as determined by a scale and vernier and lens; the value of the force *g* of the spring, which value is obtained in a similar manner; the value of *M*, which is always constant, and then work out the equation, and the result will give the difference of potential of the two plates. The difference of potentials between the poles of a Daniell's cell, as determined by this instrument, is equal to .00374. This is, therefore, the unit potential in the same manner as 1 volt of electromotive force of a Daniel cell is a unit of electromotive force, and herein is noticed the mathematical proof that difference of potentials is not identical to electromotive force. They are proportional but not equal. The Edelmann modified form (Figs. 7 and 8) of Thomson's quadrant electrometer differs from the latter in that the aluminum needle is not hung by a bifilar suspension, but that a small magnetic needle *n s* is supported by a unifilar fibre and remains therefore in the same position, when not in use, by the action of the earth's magnetism. The instrument consists of the vertical cylinder *G*, of which a cross section would be represented by an annular ring. The cylinder is provided with flanges which are fastened to the rings *R* and *S*. The cylinder is not of one piece of metal, but is made up of quadrants, each insulated from those adjacent, but electrically connected as to those diagonally opposite, while the rings *R* and *S* are made of an insulating substance. The terminals of each pair are at *A* and *B*, respectively. Inside the cylinder *G* hangs a needle *W* of rectangular form, and underneath the latter is suspended a piece of platinum which dips into sulphuric acid contained in a glass vessel supported by the ring *S*. Into the acid dips also the platinum wire *r*, fixed to the annular disc *z*. There is electrical communication from the outside by wire *p* so that, the outside surface of *T* being covered with tin-foil, *T* is converted into a Leyden jar which serves to keep the needle *W* highly charged. The whole instrument is supported by a frame adapted to be fixed to the wall of the laboratory always convenient for use.

The exhibit of the firm named displayed not only the finest workmanship and mechanical skill; but every one had a chance to see the instruments tested in a dark room

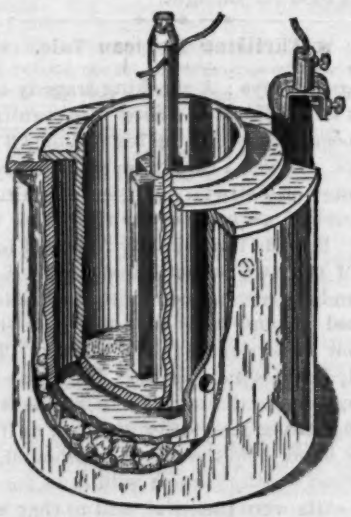


FIG. 1.

provided for the purpose, so that their manner of working and the effects produced by them under the best conditions could be observed, and so that it would awaken a more general interest in the minds of the public as to these matters of scientific interest so little understood and appreciated. A dark room was erected twenty-two feet long and ten feet wide and was fitted up with electric lanterns and complete apparatus for projections on the screen and for all experiments requiring a dark chamber, not only for electrometers but also for the exhibition of Geissler tubes, Crookes tubes and projections of all kinds.

James W. Queen & Co. in their dealings with such foreign firms as Elliot Brothers, London; White, Glasgow; Carpentier and Brequet, France; Ayrton and Perry, London; Edelmann, Hartmann, Siemens Brothers, etc., have, with many years' experience, come to the conclusion that, as skilled labor is cheaper in Europe than here, as there are more scientific men there who devote themselves to the supervision of the manufacture of such apparatus, and have them made under their personal care and guidance, they can import instruments to greater advantage than they can procure them in this country. There is food for reflection in their statement.

Kauffer's Electric Batteries.

The large extent to which open circuit batteries are now employed has stimulated research in the direction of devising means for the production of current and reducing the renewal and care of battery and materials. One of the latest attempts in this direction is exhibited in the Kauffer open-circuit batteries, of which there are two sizes, shown in Figs. 1 and 2. Unlike the old style of batteries, this one has the zinc placed in the porous cup,

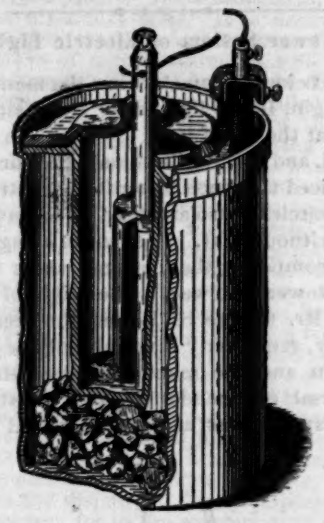


FIG. 2.

which is itself suspended in another cup, perforated so as to allow free access to the liquid. Outside of this is placed the carbon rod, which dips into a solution of bichromate of potash contained in the outer glass jar. The inner cup requires nothing but water for the immersion of the zinc. The cell shown in Fig. 2 is similar in principle to the former, but contains only a single porous cup. It is asserted that three of these large cells will do the work of twelve Leclanché cells, with the further advantage that if by accident the circuit be closed for twenty-four hours or more, the cell does not need to be cleaned and renewed, but in a few minutes after the circuit is opened will do the work as well as before. For intermittent work, such as is required with stock indicators, the saving in cost and material has, it is claimed, been shown to be considerable.

Kauffer's closed-circuit gravity battery, shown in Fig. 3, presents some novelty in arrangement which enhances its value, and is said to render it superior to the old form of gravity. In this, as in the former batteries, the zinc is inclosed in a porous cup. In regard to this cell, Prof. A. E. Dolbear says it is the best constant cell which has come under his notice. He also adds that "its electromotive force and internal resistance are about the same as those of a very good Daniell cell, but on account of mechanical arrangement of the parts it is not subject to such troubles as beset a gravity cell. The porous cell for the zinc secures the latter from the deposition of copper and keeps it clean and available for service as long as there is any. The covering not only prevents evaporation but prevents the creeping of the zinc sulphate to the outside of the cell, and the cell therefore keeps clean and does not need watching. As for its constancy, there is no doubt about its being able to do continuous work for months without attention."

This indorsement from so good an authority speaks well for the battery, and its adoption and continued use by the Boston Fire Department bears out the statement as to its efficiency.

The Gold & Stock Tax Case.

We give below the decision of the Court of Appeals in the case of the People against the Gold & Stock Telegraph Company:

The court sustains the decision of the General Term, except in so far as relates to interest for non-payment of taxes at the date on which they were due. The opinion, written by Judge Danforth, is that the tax claimed by the State is a tax upon the corporate franchise, and is therefore collectible under the act of 1881, chapter 361. He says:

The act of 1881 deals, as its title declares, with the subject of taxation of corporations and no other matter. It is "An act to provide for raising taxes for the use of the State, upon certain corporations, joint stock companies, and associations." What these terms include is declared by section 3 in language so comprehensive and clear as to leave little room for interpretation. It reads as follows: "Every corporation, joint stock company, or association whatever, now or hereafter incorporated or organized under any law of this State, or now or hereafter incorporated or organized by or under the laws of any other State or county, and doing business in this State, except saving banks," and some other institutions, corporations, and companies, among which telegraph companies are not named, "shall be subject to and pay a tax, as a tax upon its corporate franchise or business, into the Treasury of the State annually, to be computed as follows: If the dividend or dividends made or declared by such corporation, joint stock company or association, during any year ending with the first day of November, amount to 6 or more than 6 per centum upon the par value of its capital stock, then the tax to be at the rate of ¼ mill upon the capital stock for each 1 per centum of dividend so made or declared; or, if no dividend be made or declared, or if the dividend or dividends made or declared do not amount to 6 per centum upon the par value of said capital stock, then the tax to be at the rate of 1½ mills upon each dollar of a valuation of the said capital stock, made in accordance with the provisions of the first section of this act," and other provisions intended to meet cases not before provided for.

Section 1 requires a report from each of these organizations, and section 4 requires the amount estimated under the provisions of the act to be transmitted to the Treasury of the State within 15 days after the 1st day of January in each year.

Notwithstanding the explicit language of these sections, the extended and very ingenious argument of the learned counsel for the appellant rests upon the contention that the limitation permitted by the act of 1853, by which, for the purpose of taxation, the capital stock of a telegraph company is the cost of its works within this State, so restrains and governs the act of 1881 that the words capital stock as there used shall be construed as if they carried with them the same words of qualification. And this presents the only important question in the case. Undoubtedly the section (3) referred to relates to a special matter and to the special class of corporations to which the defendant belongs, and the argument for the appellant is put upon a series of authorities—text writers and the decisions of courts—which determine that an act directed toward a special object or a particular class of persons will not be repealed by a subsequent general act embracing in general terms those particular objects or persons, unless some reference be made directly or by necessary inference to the special act. This rule, however, is only one of many by which courts seek the intent of the Legislature, which, it is said, they have always taken "according to the necessity of the matter, and, according to that which is consonant to reason and good discretion." (Stradling vs. Morgan, 1 Plowden, 204.) I should therefore be prepared to agree with the appellant that the act of 1881 did not repeal the provision of 1853, in the respect referred to, if I did not find in the latter act both affirmative and negative provisions so in conflict with those of the former special act that the Legislature could not have intended the two should stand together. We find in section 6 of the act of 1881 (supra) telegraph companies named with railroad and other corporations, and concerning them an enactment that "in addition" to the taxes above provided for they shall pay "as a tax upon corporate franchise or business" at the rate of five-tenths of 1 per cent. upon gross earnings for telegraph business "transacted in this State." Thus every 6 per cent. dividend paying corporation (not excepted

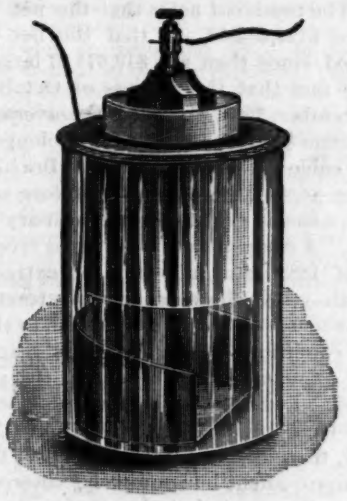


FIG. 3.

in terms) is subject to a tax upon its "corporate franchise or business," limited only by relation to the amount of its capital stock, and "every telegraph company" though merely incorporated, and whether dividend-paying or not, is subject to another tax upon its "corporate franchise or business," estimated upon its gross earnings within the State.

It would greatly diminish the scope of the provisions by which the first is imposed, and defeat the apparent intent of the Legislature, for a court to say that a corporation which, within the letter of the law, owed a tax to the State upon $5,000,000 capital, *eo nomine*, could be discharged upon payment of a tax estimated on a certain proportion only of the cost of its works. Nor could it be said without disregarding the rule which, in the construction of a statute, requires the differing language of the Legislature to be observed. In the first case, the entire capital, whether expended within or without the State, is made the basis of taxation, and in the second such earnings only as are made within the State; and in view of

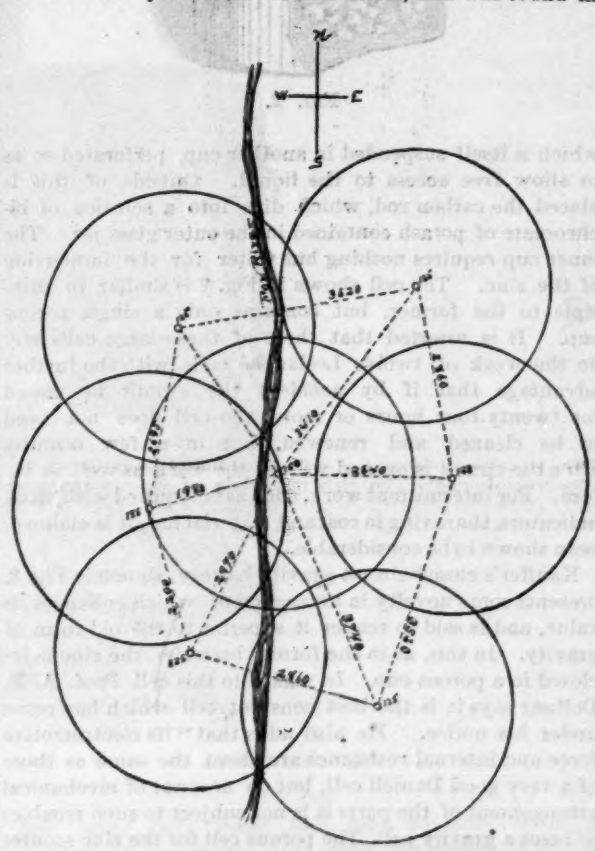
the express language of the statute, to make the implication required by the appellant, would amount to an act of judicial legislation and sanction the omission of a duty imposed in terms upon every corporation, whenever and howsoever organized. It would relieve one from a liability to which all are declared subject, and introduce confusion into a scheme which was intended to be equal and harmonious. We find no reason in the nature of things nor authority for doing it. The act of 1881 was not in furtherance of an existing system, but introduced a new method of regulating the amount of corporate contribution to the payment of State expenses by assessment, not upon property, but upon privilege and business. To that end the scheme is a complete and independent one. It is made just and perfect in this respect by declaring (S. 8) that the corporations, joint stock companies, and associations mentioned in it as taxable shall thereafter be exempt from assessment and taxation for State purposes, except upon their real estate, and as therein provided, but shall in other respects be liable to assessment and taxation as theretofore. So far, therefore, as those purposes are provided for by the act of 1853 (S. 3 supra), the latter is, by necessary implication, repealed. The Legislature must no doubt be presumed to have known of the existence of the earlier statute, and its repeal might have been the subject of express enactments, but in the respect named the two acts are so repugnant that they cannot stand together. In the one, taxation upon property; in the other, taxation upon franchise and business; in the one, the thing taxed, estimated by the actual cost of works upon which capital has been expended; in the other, estimated by the amount of capital itself, with an exemption from other assessment or taxation except as therein provided. The whole law indeed is not repealed, but as much only as relates to these purposes. In other words, the effect of the act of 1881 is to take taxation for State purposes out of the operation of the act of 1853. The same result is reached under a rule now well settled, by which a later statute, covering the same subject matter and embracing new provisions, operates to repeal a former act, even if the two are not in express terms repugnant. (Heckmann vs. Pinkney, 81 N. Y., 211.)

Central and South American Telegraphs.

President James A. Scrymser, of the Central & South American Telegraph Company, has issued a report covering the operations of the company to Jan. 13, 1885, which shows that the company is out of debt, has surplus net earnings of nearly $30,000 and 9,934 shares of capital stock in the treasury. The balance sheet given is actual to Oct. 31, 1884, and estimated to Jan. 13, 1885. Condensed, it shows the cost of the plant to be $4,347,710.78; the capital stock, $5,000,000, with 9,934 shares, as above, in the treasury. The net earnings to Oct. 31 last were $336,443.35, and to Jan. 13, 1885, being partially estimated, $370,962.35. Of this, there has been paid for construction $341,110.78, leaving an estimated balance of net earnings unexpended, Jan. 13, of $29,851.57. The treasury stock is valued at par, which gives the company available assets of the nominal value of $1,023,251.57. The market quotation for the stock is 105 asked. The president notes that the net profits Dec. 31, 1883, were $175,643.69, and that the net profits for a similar period since then are $19,674.97 larger, notwithstanding the fact that the receipts of October, November and December, 1883, exceeded the average monthly receipts by some $50,000, owing to a prolonged interruption of the cable between Europe and Brazil. The extraordinary receipts in 1883 were therefore considerably surpassed by a steady growth in the ordinary earnings of the last year. A comparison of the gross receipts of 1884 with those of 1883, after allowing for extraordinary receipts in both years, shows a normal growth in traffic of over 35 per cent. This was mainly due to the improved commercial condition of the countries reached by the lines of the company, notwithstanding the general dullness of trade, and although both the through and local tariffs have been reduced from 15 to 50 per cent. It is evident, therefore, the president says, that, with a continued improvement in commercial intercourse, there is every reason to expect that the company will soon be firmly established as a dividend-paying concern. The recent daily traffic returns show a satisfactory improvement, indicating that both Peru and Chili are recovering from the results of a damaging war. The company's cables are in excellent condition, and have not occasioned the outlay of a dollar for the past 19 months, nor have the cables of the Mexican Telegraph Company in four years. Information regarding the durability of submarine cables is frequently asked for. The most reliable information obtainable on this point is that there are cables now in operation that have been submerged over 21 years and that they are electrically as perfect as when laid. Cables in both the North and South Atlantic have been recovered in water over a mile in depth after 10 years' submergence, and, on examination, have been found to be mechanically and electrically in excellent condition. This company's cables, being laid parallel with the coast, are exempt from the risks and costly repairs experienced by most ocean cable companies. The land lines have been maintained in excellent condition. Every message between Galveston and Valparaiso is timed from station to station. The average time of transmission between Galveston and Valparaiso, for the past six months, has been under 65 minutes. The Western Union Telegraph Company has recently been working a direct wire between Galveston and New York, by which means it is estimated that the average time of transmission between London and Valparaiso is under one hour and a half. The Argentine minister, under date of Sept. 18, 1884, reports that his government has made a special appropriation for the erection of two additional wires between Buenos Ayres and Chili, and for the improvement of its telegraph system. The Chilian lines operated by the Transandine Telegraph Company, connecting with those of Argentina, are about laying a new cable across the Andes, and will expend $80,000 in order to improve their connection with this company's system.

The Tower System of Electric Lighting.

We publish below a plan showing the manner in which the city of Elgin, Ill., is lighted by electricity, the lamps being placed at the top of lofty towers. The Van Depoele system is used, and the area illuminated is four square miles. It will be noticed that each tower is the centre of a circle, and that the circles are so arranged as to leave no portion of the area without light. The figures along the sides of the triangles composing the hexagon show the distances in feet from tower to tower. The height of each tower is also given. Mr. George S. Bowen, the president of the local company, remarks: "It need hardly be said that the light in Elgin and the manner of its distribution find almost universal commendation, and yet the opposition to the tower system was at first bitter, and was found in



PLAN OF ELECTRIC LIGHTING SYSTEM AT ELGIN, ILL.

the various electric light companies as well as outside of them. The success in Elgin has almost entirely overcome the local prejudice, and the tower system stands pre-eminent as the one for city lighting. Elgin has seven towers, of which six are 125 feet in height, and one 150 feet. On them is a total of 29 lamps of 2,000 candle-power each. The city contracts with the electric light company (which owns the entire plant, towers and all), for five years, at $6,800 per year." Tower lighting has already been adopted by several cities, and promises to become even more popular.

Long Spans with Silicious Bronze Wires.

The excellent results which have been obtained in Europe with silicious bronze conductors cannot fail to bring about their introduction in this country. Its valuable properties consist, not alone in its high conductivity, but also in its great strength, which permits of spans never attempted with the old iron conductor. The early specimens of this wire for telegraph purposes had a conductivity of 97 per cent., and a resistance to rupture of about 28½ tons to the square inch, that for telephone purposes having a conductivity of 32 per cent. and a resistance to rupture of 47½ tons to the square inch.

Quite recently, there has been developed a new type of telegraph wire, possessing less conductivity than the former, but having considerably higher tensile strength, which allows the wire to be more tightly strained, while the posts may be placed at greater distances apart. This new wire has a conductivity of 80 per cent., and a tensile strength varying from 35 to 37 tons to the square inch. At the same time the character of the telephone wire has also been changed, raising its conductivity to 42 per cent. and its tensile strength to 52 tons. There is also manufactured a special type for wide spans with a conductivity of 21 per cent. and a tensile strength of from 69 to 85 tons to the square inch. These remarkable properties give the silicious bronze wire very great value, and we thus find that at Prague, Trieste, Lemberg, Pilsen and other cities it is used exclusively for telephone lines. That at Trieste, in particular, has stood the test of violent storms completely, which is due to the small diameter of the conductor. A similar experience has been made at Rheims, after a very violent tempest, where in one case a line, having a span of more than 1,000 feet, was exposed to the action of the wind blowing directly across it.

Its power of resisting snow has been equally well established. Thus, on an Austrian railway, the engineer at the head of the telegraph department personally examined the wires during a violent storm of damp snow, followed by a sharp frost, at a point where the line crosses hilly ground at a height of about 2,000 feet above the sea. The wires were well covered with snow and sagged considerably more than usual. In several instances, by shaking the wires the snow was detached, when the conductors immediately assumed their normal deflections. Other wires which were not touched resumed their normal deflection after the snow had melted. The Austrian railway company above mentioned has numerous lines in which the distance varies from 328 to 720 feet across flat country; in hilly districts the distance ranges from 260 to 500 feet. During the last four years the Italian General Telephone Company has employed these wires, with spans as large as 1,000 feet, without any accident having occurred. In Vienna, telephone posts are frequently placed at the same distance apart, and carry as many as seventy-eight parallel wires.

An Undulatory Current in a Closed Circuit Not Necessary for Telephonic Transmission.

Under the above heading, the London *Electrical Review* publishes a communication in which the writer details some experiments bearing upon this subject. He connected up a Boult (De Kraft) transmitter and receiver, using three medium-size Leclanché cells connected to the carbon microphone through the automatic transmitter, in which he used a ribbon of paper having a line of small holes very close together, running longitudinally through the centre, similar to the paper used by the Wheatstone instrument. The automatic transmitter was then put in motion, and the paper was passed over the metallic drum beneath the wire brush, which made the contacts through the holes in the paper, and allowed the current to pass on through the microphone at a speed of about 1,000 words in one minute. While this paper was passing, and the continuity of the current was continually broken, words spoken directly to the carbon microphone without the intermediary of a diaphragm, and without any substance whatever below the carbons, were distinctly heard from the receiver, and the articulation was as perfect as when the current was continuous.

With these facts as a premise, the writer reasons that the closed circuit is not necessary for telephonic transmission, and that Bell's theory to the contrary is thus experimentally disproved. Whether such an assumption is warranted in the light of the above facts, remains to be shown more clearly. We, therefore, submit the above to our readers as food for thought.

A Thrilling Mexican Tale.

A Mexican paper says: A shocking tragedy occurred on Sunday night in the Zocalo, where the beautiful concert pavilion has been erected for the festival of All Saints' and All Souls' days. It was a case of peculiar interest. A man known as Pantaleon Estrada, a worker on guitars, tying a stone to the end of an ordinary wire, threw it over the electric wire. Estrada immediately fell dead in his tracks. The contact of the two wires killed him. A policeman standing by and a street-car conductor had much of their clothing burned off, and were themselves so seriously injured that their lives tremble in the balance. The electric current affected others more or less. The scene succeeding the tragedy was demoralizing. For a moment the dumb terror of seeing strong men totter and fall, as if struck by some invisible hand, held the crowd spellbound. Succeeding the terrorized apathy came a wild rush for life. Fortunately, the exits were plentiful, and to that was due the fact that many were not stamped to death.

John Herbert, of the electric light company, mounted a ladder, with a silk handkerchief in hand, to remove the wire thrown by the unfortunate Estrada. The rain was falling heavily at the time, but he did not notice that the handkerchief was becoming damp. He applied it to the wire to remove it, and received himself a severe shock that threw him from the ladder. Falling to the stone pavement, his head was cut open. He will recover. The people believe that Estrada represented a gang of pickpockets and thieves; that his object in throwing the wire was to extinguish the electric lights and give his pals a chance to operate. Whether that was so or not is not known, for he who could have told has had his lips burned to silence.

Conduits in Philadelphia.—The sub-committee of the Electrical Committee of Councils, appointed to consider underground conduits, discussed, on the 24th, the bill of the People's Underground Electric Company. The bill was amended so as to provide that the work should be subject to the approval of the Board of Highway Supervisors, and five miles of conduit must be laid within a year after the passage of the bill granting such privilege.

The Bell Patent Null and Void in Canada.

On Saturday last, the 24th, the Hon. J. H. Pope, the Canadian Minister of Agriculture and Commissioner of Patents, rendered decision *in re* the Toronto Telephone Company vs. The Bell Telephone Company of Canada. This is a case of dispute raised against the existence of Patent No. 7,789, granted the 22d of August, 1877, to Alexander Graham Bell, and now owned by the Bell Telephone Company of Canada, for alleged forfeiture on the ground of non-manufacturing and of importing, in the terms of section 28 of "The Patent Act of 1872." The petition addressed to the Minister of Agriculture (bearing date 2d September, 1884) by the disputants, represented that the patent No. 7,789 is null and void, and should be so declared, for non-compliance with the provisions of the 28th section of the Patent act of 1872, requiring manufacturing within two years and forbidding importation after twelve months.

The following is the full text of the decision: This case is the second which has come before this tribunal. It happens that both cases concern interests of vast magnitude, a circumstance which contributed to enhance the sense of the heavy responsibility imposed by the law on me as the Minister of Agriculture, or on my deputy, in this respect. The first case—Barter vs. Smith—was tried before Mr. Tache in November, 1876, and his judgment was rendered in February, 1877. I have to refer to that judgment because it has been made the basis of argument by the learned counsel on both sides in this case, because it constitutes the declaratory law of the country on points raised by the application of the 28th section of the Patent act of 1872, being in matter of doctrine and of legal interpretation unquestionably correct; and indorsed, as remarked by Mr. Cameron, by the highest judicial authorities—namely, the Court of Appeal of Ontario, the Supreme Court, and, in relation to this present case, by Mr. Justice Osler in his judgment rejecting an application for a writ of prohibition. This tribunal is, therefore, bound to attach great weight to the doctrine and rules of interpretation laid down in that judgment of the Deputy Minister, which judgment embodies the jurisprudence adopted in Canada, when dealing with that section of the Patent act.

The feature of patent No. 7,789, granted for what is known under the name of "Bell's system of telephony," is peculiar in so far as it consists both of a process of art and of a portion of the machinery necessary to carry the art into practice. The two elements are inseparable; the electric circuit and the two instruments are the means of giving a practical and tangible shape to the "Bell's system of telephony." Moreover, the instruments, described in the specification and illustrated in the drawings of the patent, are the mechanical contrivances which distinguish this invention from other methods of getting at a similar result. All the elements of which these instruments are composed are of the public domain, and public are also the means of erecting an electric circuit, therefore, the patent is a patent for a new and useful combination of old elements, to obtain an object known beforehand. The combination is the invention, and consequently, the subject matter of the patent and the mechanism of which it is constituted are new articles of manufacture. The doctrine universally admitted of the patentability of a variety of combinations of the same elements for the same object has been clearly laid down by the Supreme Court in Smith vs. Goldie. What is patentable is the subject of a privilege, and, in Canada, submitted to the conditions of section 28 of the Patent act. This patent, like every other patent granted, is, therefore, under the obligations exacted from all patentees by section 28 of the Patent act of 1872, and subject to the adjudication of this tribunal, should disputes arise as to whether it has or has not become null and void under the provisions of this section. The patent was granted on the 22d of August, 1877, to Mr. Alexander Graham Bell, and is now, through a series of assignments, the property of "The Bell Telephone Company of Canada," the respondents in this case. It must be remarked that it matters not who the owners are for the time being, or were at any time; it is the patent which stands before me as the Minister of Agriculture to be adjudicated on, not the owners. The patent does so stand with the uninterrupted privileges as well as with the uninterrupted obligations attached to it. This tribunal has not to investigate the *locus standi* of disputants nor of respondents, nor in relation to companies, to inquire whether they are legally incorporated or not; such questions are not within its jurisdiction, and, besides, are quite indifferent to the issue in such cases. When this tribunal is made aware that disputes are raised, in accordance with the provisions of the 28th section, by some person who undertakes to prove his allegations, it immediately becomes the duty of the judges of such disputes to investigate the matter, in the interest of public rights, if the policy of the law has not been carried out, or in the interest of patent rights if the obligations have been fulfilled. I, as Minister of Agriculture, have not to undertake to initiate cases of disputes, but I must take notice of all cases brought before me in a formal way. The first allegations of the petitioners in this case are that illegal importations have been made of the patented articles, after twelve months from the date of the patent, specifically in the latter days of August, 1878, in January, 1879, and during the years 1880 and 1881. The facts of the first alleged act of illegal importation are as follows: During the first year of the existence of the patent, the patentee or his representatives in Canada had contracted with Mr. Charles Williams, of Boston, in the United States, for one thousand telephones, to be delivered within the twelve months allowed by law for importing the invention. At the expiration of the twelve months Mr. Williams had not been able to complete his contract, more than half of the number contracted for having not been furnished. Under the misapprehension created by the date of registering of the patent (24th August) that twelve months would only expire with the 24th day of August, 1878, Mr. Williams did forward from Boston, on the 23d of the same month, a lot of seventy-five telephones, which, in the ordinary course of transit, should have entered Canada on the 24th, but which, owing to some mishap, did actually pass the frontier only a few days after. The circumstances of these facts show that there was no intention to break through the law, and that the importation was not considerable; therefore this case of importation in the latter part of the month of August, 1878, cannot entail the voidance of the patent. At the same time that no stress is put upon these facts, it is, nevertheless, an occasion to warn patentees in general against the danger of running so close to the expiry of the twelve months as to incur the risk of coming even a day too late with their last importation. This tribunal is a paternal tribunal, the judges of which are the natural protectors of patentees' rights, and, as such, bound to give to the facts the most liberal construction consistent with a compliance with the spirit of the law; but the patentees are the first guardians of their own interests, and should not put their property in jeopardy by placing these judges in the position of being obliged to overstretch leniency in order to save their patents. During the first year of the existence of the patent then, the patentee, or his legal representatives, imported, or caused to be imported, about five hundred instruments ready for use, as they had a right to do; a few days after the expiration of the twelve months they also imported, or caused to be imported, seventy-five complete instruments, which latter importation being inconsiderable, and apparently done in good faith, and not with any intention to evade the law, is declared not to have forfeited the patent. There remains now to examine what was done after that time. It is desirable, first, to enter into a cursory examination of the instruments patented as new articles of manufacture. It will, however, be sufficient to investigate the elements of one of these two instruments, the one commonly called the "Hand Telephone," represented in figure 6 of the drawings of the patent. It consists: 1st, of a casing with a side cover, the whole being at the same time a handle, with a flat ring piece fixed to it, called disc in the trade, and a perforated cup-like screwed top, the whole and the four distinct parts of which are of a form special to this new article of manufacture; this handle casing may be made of any suitable materials, but as a matter of fact is in this case made of hard rubber; 2d, of four bars of magnetized steel, bound together by screws and nuts; 3d, of two soft iron pieces called drop forgings; 4th, of a bobbin on which silk covered small copper wires are rolled around; 5th, of wire posts, also called screw cups, and a regulating screw; 6th, of a metallic vibrating plate or diaphragm, sometimes called disc, as a matter of fact cut out and otherwise worked from what are commonly called japaned or ferrotype plates; 7th, of few other insignificant articles of construction. It will expedite matters to consider, together, the two questions raised in the dispute of illegal importation and of non-manufacture; for in the measure that illegal importation goes on, in that measure the industry and the labor of the country are deprived of the benefit of manufacturing. Therefore, we have to examine what, in these instruments, is raw material, which does not fall under the application of the 28th section, and what are industry and labor; because it is clear that if the aggregate amount of industry and labor entering into the making of such instruments was mere trifling unless a criminal intention of totally disregarding the law was shown, which is not the case here, it would not be a liberal nor a reasonable interpretation of the spirit of the law to destroy the patent on account of its importation or non-manufacture; if it were, for instance, amounting in all to a value of ten dollars a year, as the learned counsel Mr. Macdonald has it, with the Latin maxim—*de minimis non curat lex*—or even if it were ten times as much as that for every year. As already said, it will suffice to confine our study of the case to the examination of one of the two instruments patented—the "hand telephone." The raw materials of this instrument comprise steel in bars, soft iron, wood and vulcanized rubber, to which must be added, as common articles of commerce, silk-covered wires, japaned plates or sheets of ferrotype, as some call them, screws, nuts, and may be wire posts. The value of each hand telephone complete is about $2.00; the value of the raw materials, including common articles of commerce entering in each instrument, may be said with certainty not to reach the aggregate of $0.90. Therefore the industry and labor put upon each of these instruments may be set down at about $1.10. One would be inclined to take a much more exalted idea of the value of the labor put upon the two instruments patented from the statement, made by Mr. Sise, the general manager of the Bell Telephone Company of Canada, that their telephone factory at Montreal, established in 1882, has $50,000 capital invested in it, and that the pay roll of that factory amounts to $30,000 a year wages; notwithstanding that the rubber handles of the hand telephone are not yet manufactured in Canada, as we have it from Mr. Sise, who says that they cannot get them made in Canada, having again vainly tried to do so a week before he gave his evidence in this case; which, of course, can only mean that the Bell Telephone Company have not procured for themselves the molds to manufacture those rubber handles. Although Mr. Sise does not discriminate the work done at their Montreal factory, it is clear that such an amount of yearly wages cannot be exclusively devoted to the making of the two instruments patented in Patent No. 7,789; but the statement, with all its surroundings, proves that the manufacture of the two instruments is not an insignificant trifle, but is, on the contrary, an advantage worth being looked after; there are many thousands of them now in use in Canada, and there were, at least, several thousands when the Montreal factory was started. The question comes then: Has the patentee or his legal representatives imported, or caused to be imported, after twelve months of the existence of their patent, the new article of manufacture patented? There cannot be a shadow of doubt that they have so imported, or caused to be imported, the articles manufactured in parts, to be simply put together at an amount of labor, at times paid 30c., at other times 27c., in Canada. It is, in fact, virtually admitted by them when pleading that putting together or "assembling" the parts ready made, is construction and manufacture in the meaning of the law. It is equally evident that, during the same period, that is, coming to the year 1882, they have failed to manufacture to the extent that they have imported, and that, from the year 1882 to the date of hearing the evidence of Mr. Sise, the 3d December, 1884, they had been importing the rubber handles in a manufactured state. The intention, although not malicious, to evade the law, is nevertheless manifest. During that considerable time of the existence of the patent (to 1882) the same foreign manufacturer, Mr. Williams, with whom the patent owners had contracted for one thousand telephones to be delivered during the first twelve months of the life of the patent, and who furnished only about five hundred during that period of time, did continue to send them to Canada for years, to supply an ever increasing demand; but to evade the law and give a color to the importation, instead of sending these instruments consigned to the patentee's representatives, he sent them in pieces to be put together in Canada, to some one through whose intermediary the patentee's representatives received them when "assembled." All this is proved in the clearest manner by Customs papers, by accounts furnished, by declarations from one of the Cowherd, from Mr. Foster, and by correspondence on the subject. We have it from Mr. Sise himself, with some reticence, but also with some details. He explains the reason why this importation and this non-manufacture were resorted to. "Mr. Charles Williams, one of the owners of the patents," says Mr. Sise, "was and is the only manufacturer of Bell telephones in the United States; he is the only man who is licensed by the Bell Telephone Company to manufacture telephones; he is the only manufacturer to-day that I have any knowledge of . . . Mr. Charles Williams was the only man who had that knowledge of it, and who had the control of Cowherd's shop . . . I think we paid Williams, and I think he was the man who employed Cowherd. . . . Mr. Williams having arranged with Mr. Cowherd to manufacture in Canada, Mr. Cowherd had a number of machines on hand (at the time of Cowherd's death), and Mr. Foster continued the manufacture, and my impression is that he continued to contract with Mr. Foster until we got our shops in such shape that we could make ourselves. . . . There was no time or period when we were not supplied with telephones for the public, either from Cowherd, Mr. Foster or our own manufacture. They were continuously manufactured, inasmuch as they were ready for the public always when they came for them." So far as the law requires a prompt introduction in Canada of a patentee's invention, the patentees have observed the law, as Mr. Sise remarks; but the protective policy of the Patent act, they have, in intention and effect, disregarded, and defeated to a very large amount the industrial manufacturing value of the patented article. In support of the pleading that the importation of an instrument in parts is no importation, Mr. Wood, on behalf of the respondents, quoted a recent ruling of the English courts (Townsend vs. Hawthorne), in which case it was decided that the importation of the materials of a composition of matter was no infringement of the patent, and, says the learned counsel with reason so far, what is no matter of infringement cannot be a matter for illegal importation. So far so good; but the conclusion, which is correct in the abstract, fails in the concrete, as applied to the present case. The materials of the composition are raw materials unworked, such as would be, in the present case, steel in bars, iron as a commercial article of trade, rubber and even silk covered wires; but these are worked into shape and form, to constitute a Bell telephone, they cease to be raw materials and become a manufactured article. Mr. Tache, in his judgment, has anticipated the ruling of the English courts, in the very species of case cited by Mr. Wood. "It is not difficult," says Mr. Tache, "to imagine a case in which the importation of all and every one of the component parts of an invention, to be simply put together in Canada, would not be an importation in the meaning of section 28 of the Patent Act . . . for example, the case of a patent granted for a composition of matter." It is immediately after this that Mr. Tache adds, referring to such cases: "Every one of which must stand on its own merits." The other and last allegation of the disputants is that the patentees have refused to sell their invention after two years of the existence of their patent—namely, to the inhabitants of Port Perry in 1882, to Messrs. Lohnes & McKenzie in 1884, to others, and generally refused to sell in order to monopolize the control of telephonic operations throughout Canada, and derive from their invention more than they were entitled to for the use thereof A question has been raised on the meaning of the words sale and license as applied to patents. One of the learned counsel was under a misapprehension about the signification of the words used by Mr. Tache in his decision—"license the right of using on reasonable terms." In this sentence the word license is used in its broad technical sense in patent science; it does not mean a lease upon payment of a rental, but the absolute transfer of a property which becomes vested in the licensee or purchaser *quoad* the result suggested by the nature of the invention and the extent of the purchase in point of number. Of course, if one or many of the public prefer to lease and agree to do so, there is no disability created by the law to prevent them from entering into such a contract. There are, in the nature of things, three sorts of contracts in relation to patents: 1st. The license to use, or by the purchaser furnishing himself with the means to use. 2d. The sale of the means to use the invention. 3d. The assignment of the whole or portion of the patentee's privileges. As tersely expressed by Judge Hall, in Pitts vs. Hall (2 Blatchford, 229), "a license, or assignment, or sale of a machine is a transfer, *pro tanto*, of the property secured by the patent." In these cases, however, it must be borne in mind that our Patent act differs essentially from the English and the present American laws. Our patentees are bound to license, that is, to sell the use of their invention, and bound to see that their invention is not imported after twelve months, and that it be manufactured in Canada after two years, because connivance in an importation is equal to importing or causing to be imported. On the contrary, the English and American patentees are at liberty to import and at liberty to entirely withhold from the public use their inventions if they choose so to do; therefore, they can select their own conditions in a contract, in the nature of which they are bound, of course, when entered upon, but into which they are not forced by law. The instances of refusal to sell which were the subject of evidence in this case are several, but, with the exception of three, they are mixed, or seem to be mixed, with demands to use poles, wires, communication with lines and exchanges, which, naturally, the patentees are not bound to furnish. The three clear instances of refusal are: 1st, the case of Mr. Bate, of Ottawa, commenced in April, 1883; 2d, the case of Mr. Dickson, of Montreal, commenced in November, 1883; 3d, the case of Mr. Richard Dinnis, of Toronto, commenced in March, 1884. The correspondence is completed and certified by statutory declarations. In the case of Mr. Bate, he wrote on the 14th April, 1883, to the Bell Telephone Company of Canada, asking them to give him their lowest price for three telephones, including transmitters, for a private line, he was answered by Mr. McFarlane that their agent at Ottawa was directed to call on Mr. Bate. Mr. Bate wrote a second letter to the company to explain that he wanted to purchase and not to rent the instruments. Mr. Sise, in answering this second letter, intimated to Mr. Bate the following: "We do not sell telephones, but we rent them." In the case of Mr. Dickson a protracted correspondence took place, first opened with Mr. Scott, agent of the company, to be continued with Mr. Sise, in which Mr. Dickson insisted on his right to get the instruments as his property, according to

law, and Mr. Scott and Mr. Sise declined to sell, but offered to lease or rent. To close the correspondence, Mr. Dickson informed the company that being thus denied the purchase of the instruments, he had decided to have them constructed himself for his own use; to which threat Mr. Sise answered that they could not consent to an unconditional transfer, but would sell a Bell Telephone for thirty dollars, subject to the stipulation "that it is to be used only between certain specified points." In the case of Mr. Richard Dinnis, he wanted to purchase three sets of telephones to connect his office, his residence and his factory, and asked to be informed of the cost. Mr. Sise answered him that they had never sold these instruments, but that he (Mr. Dinnis) could have three sets rented at the rate of $20 per annum, he (Mr. Dinnis) building his own line; but that he would sell the instruments to him for $100 per set, to be used only for the purpose stated by Mr. Dinnis. Mr. Sise refers Mr. Dinnis to Mr. Neilson, agent of the company at Toronto, for further information. Mr. R. Dinnis, in an interview with Mr. Neilson, accompanied by Mr. Arthur Dinnis, both of whom render an account of the interview by statutory declarations, tried to get information from Mr. Neilson about prices, and asked if he could get the instruments at a more reasonable price and unconditionally, but was answered by Mr. Neilson that he could not give any other answer than the one contained in the letter of Mr. Sise. The price was unreasonable and with a limitation of use. The case of Mr. Bate was one of flat refusal. The two other cases were instances of protracted resistance, ended by offers to sell under restrictions, some of which were beyond the privileges of a patentee. The limitation as to where to use the invention after purchase is similar to a sale of a patented sewing machine to be used only in a particular house, or the sale of a patented plow to work only a given plot of land. The patent license in Canada accompanies the purchaser wherever he choses to move on the wide territory of the Confederation, provided he does not use more than the number of articles purchased. The policy of refusal to license, or sell, for the purpose of leasing at a rental, is made plain again by the answers, although very reticent, of the manager of the company to the interrogatories of counsel. A few quotations of his evidence will suffice: "I do not think," says Mr. Sise, "there has ever been a set sold by us." "I would not swear that we have not refused to sell private telephones. I would not say we did." "I should not be able to say whether we had absolutely refused to sell unconditionally one or two or more instruments, nor would I say that we had not." "I do not think we ever sold an instrument unconditionally." The whole case is plain on the face of it; and it is also plain that the patentees or their representatives had in view to build up a commercial enterprise (for the benefit of the public, as they contend) rather than to content themselves with getting their mere royalty on licenses or sales as patentees. With such intention simply, there is nothing to find fault, so far as this tribunal is concerned, if the steps necessary to carry it out had not led them beyond the provisions of the Patent act.

The conclusion is, that the patentees, the respondent in this case, or their representatives, having extensively imported the patented articles, after the expiration of twelve months from the date of their patent; having not manufactured in Canada the said articles to the extent they were bound to do, after two years of the existence of their privilege; having resisted and refused to sell or deliver licenses as required by the statute, to persons willing to pay a reasonable price, for the private and free use of the patented invention, they have forfeited their patent.

Therefore, I decide that Alexander Graham Bell's Patent (No. 7,789) for "Bell's System of Telephony" has become null and void, under the provisions of section 28 of "The Patent act of 1872."

J. H. POPE, Minister of Agriculture.

DEPARTMENT OF AGRICULTURE, PATENT OFFICE, OTTAWA, 24th January, 1885.

The Resistance of Carbon Contacts.

The resistance of carbon points in contact to the passage of electricity is a subject of a mysterious nature, and one which derives a peculiar interest from the action of the microphone. Mr. Shellford Bidwell has undertaken a great many experiments to investigate the matter, and the results of these have been brought by Professor W. G. Adams before the Royal Society. The apparatus employed by him consisted of a light steel rod or lever balanced by a knife edge and carrying a scale-pan near one end and a counterweight near the other. The end carrying the scale-pan was allowed to rest on two pieces of electric light carbon laid one over the other, so as to form a contact between them, across which the current from a battery could travel. The scale-pan was fixed half-way between the bearing end of the lever and the pivot, so that any weight put into it was just double the pressure on the contact. With this and similar arrangements Mr. Bidwell made many measurements which we need not specify. The general results arrived at by him are both interesting and novel. He finds that when the pressure of the contact is comparatively small (say from 0 to 2 grammes) slight changes of pressure produce great changes of resistance (say from 15 to 5 ohms) as compared with the changes which take place when the pressures are comparatively high, say 10 to 50 grammes. The change of resistance due to change of pressure is also proportionately greater with weak currents than with strong ones. Changes of current produce proportionately greater changes of resistance with small currents than with large ones, and with light pressures than with heavy ones. When the resistance of a carbon contact has been reduced by an increase of pressure, it will, on the removal of that pressure, rise to nearly its old value. A very curious result is, that within certain limits depending upon pressure, the passage of a current causes a permanent diminution in the resistance, and the stronger the current the greater will be such diminution; but when the strength of the current exceeds a certain limit, the resistance is greatly and permanently increased. The greater the pressure the higher is such limit. Mr. Bidwell also shows that the fall of resistance attending increased pressure is greater than that due to increased pressure alone, and is partly due to increased strength of current. He does not consider it proved that the diminished resistance of the contacts under pressure is an effect of temperature. With metal contacts Mr. Bidwell finds that the weaker the current the higher the resistance, keeping the pressure fixed. Increase in the strength of current diminishes the resistance, but on reducing the current again the resistance does not proportionately rise as in the case of carbon. If the metal is clean there will be a slight fall; but if it is dirty, there will be a rise. The fall of resistance due to pressure is greatest with small pressures and weak currents. For these and other reasons, such as the fusing of the metal points, Mr. Bidwell does not consider metals adapted for transmitting speech.

Electric Light Carbon Interests.

Mr. Edward H. Goff, the energetic and far-sighted president of the American Electric & Illuminating Company of Boston, on the 28th inst., in this city, closed negotiations that have been pending for some time, which have resulted in his company securing an important interest in the Boulton Carbon Company, of Cleveland, O., for himself and associates in New England.

This transaction to a great extent harmonizes large electric lighting and carbon interests, and is considered by prominent electrical people as an important move, one which will largely enhance the interests of both companies. It secures for the Cleveland people a large and valuable trade in New England, which by the arrangement just completed becomes financially interested in the carbon business. The American Company and its dependencies secure an interest in the largest and most complete carbon factory in the world, and their representatives, Messrs. Edward H. Goff, of Boston, and H. P. Frost, of New Haven, go into the directory of the carbon company. The deal is one of the largest that has recently occurred in the electrical field, and is being very favorably commented upon by the electric light people in Boston. Mr. Frost is the General Manager of the Southern New England Telephone Company. The electric light carbon industry is destined to experience a vast extension, and this move appears to be highly politic and judicious on both sides.

A New Engine.

The following is taken from the Detroit *Free Press*:

Detroit, for a number of years, has stood in the foremost rank for engine building. Not content with the channel the builders have hitherto operated in, they now seek another field, and present to the world a new engine for electric lighting. Hitherto it has been necessary, in order to produce the incandescent electric light, to provide very high-speed reciprocating engines, to obtain a uniform and high velocity in running the armature or generator of the dynamo. Considerable difficulty has been experienced in producing the absolute steadiness desired, the check received at each end of the stroke of the piston producing a magnified effect on the light. During the past year Messrs. J. R. Markle and J. B. Wayne, of this city, have had in operation an improved reciprocating engine, designed expressly to overcome this difficulty. It not coming fully up to their expectations, these gentlemen have recently built a vertical engine, and from trials made wonderful results have been obtained. It is very neat in design and compact in space, occupying only 6 feet square. The engine is slow speed (210 revolutions per minute), and about 25 horse-power. It has an 8 x 10 inch cylinder, and will be provided with an automatic cut-off. The Gardiner governor is used. One noticeable feature is the entire absence of belts and gearing, either or both of which is generally used to impart motion to the dynamo. As a substitute, the shaft of the dynamo projects until it reaches the inside face of the driving wheel of the engine, which has a separate shaft of its own. On the shaft of the dynamo is a small fly wheel, and beyond that is a friction wheel 12 inches in diameter. The inside face of the driving wheel of the engine, against which the friction wheel presses, is 60 inches in diameter. The face of the friction wheel is 4 inches, and is made of paper, the same as used in constructing paper car wheels. The main results which Messrs. Markle and Wayne sought to obtain were a simply-constructed engine of slow speed, an economical user of steam, and at the same time impart a very high and uniform speed to the armature of the dynamo. All these they have accomplished with an upright engine making 210 revolutions per minute, and imparting a speed through the friction wheel to the armature of 1,050 revolutions per minute without a perceptible jar or flicker to the light. Another important feature of this device is that four dynamos can be run by the one driving wheel by the addition of friction wheels at opposite positions on the inside face of the driving wheel, where the motion imparted is positive. Whenever any wear on the face of the friction wheel takes place, instantaneous adjustment is made by set screws. This new invention has not been designed or made to run any special dynamo, but it is so adapted that all makers of dynamos can apply and use it. The inventors have taken out patents in the United States, Canada and England.

WESTERN NOTES.

THE ELECTRICAL WORLD BRANCH OFFICE,
CHICAGO, Jan. 27, 1885.

The Iowa Union Telephone Company held its annual meeting of stockholders Jan. 15, and elected the following officers: Jas. Thompson, President; W. H. Decker, Vice-President; Jas. T. Lane, F. H. Griggs, E. A. Benson, H. H. Matlock, A. Burdick, C. J. French and G. W. Cable, Directors. A. F. Cutter holds over as Secretary, and W. A. Leary was re-elected General Manager. The plant of the company on Jan. 1 consisted of 1,974 miles of poles, 2,625 miles of toll lines and 45 exchanges. The company earned last year about six per cent. on its capital stock, and this money will be used to defray construction expenses.

The Iowa & Minnesota Telephone Company moved its offices to Davenport, Jan. 12, and will hereafter have its offices with the Iowa Union Company. The annual meeting of the company was held Jan. 15. F. H. Griggs was elected President; J. T. Lane, Vice-President; and these gentlemen, with W. H. Decker, J. K. Graves and C. Jay French compose the board of five directors. The company showed over six per cent. earnings. W. G. Peasly holds over as Secretary.

The inventors of Chicago want the patent laws amended, and to that end met at the Sherman House in that city on the evening of the 19th inst. A committee was appointed to devise means to secure the desired amendments.

John Hetzler, a telegraph operator, applied at the police station at Mansfield, O., on Saturday night, the 17th inst., for shelter. He was conducted to a cell-room and found there shortly afterward dead. From papers found on his person it was ascertained he had formerly lived in Cleveland, O. The cause of his death is not known.

The common council of Chicago held a meeting on the 23d at which the vexed question of subterranean wires was discussed, apropos of the order requiring wires to be removed or cut. The corporation counsel, in a communication to the city electrician, Professor Barrett, had asked for information relative to the progress the various companies, telegraph and telephone, were making in the premises. The professor, in reply, says in fine: The Western Union has laid three pipes of 3 inches diameter from Van Buren street to the city limits south, five 4-inch pipes from Van Buren street north to their main office, which are to be filled with wires as soon as weather will permit. This will clear the streets of the Mutual Union lines and the Clark street lines and of poles to the city limits. They have already removed 75 miles of overhead wires. The Baltimore & Ohio Company, now that the injunction is dissolved, will at once proceed to draw in all their wires. The Bankers & Merchants' Company have now about 400 miles of wire underground. The Postal Company have all their wires similarly placed. The Chicago Telephone Company have substituted aerial cable for about 2,000 wires and have removed several miles of poles and wires. In view of the above facts, which I think demonstrate in a very satisfactory manner not only the willingness but the anxiety of the various companies to adopt the recommendations and obey the mandates of the authorities in the matter of wires, the city has cause for congratulation. Chicago was the first to see the danger, and first to adopt a remedy for the cumbrous and daily increasing network of overhead wires, and has, I think to-day more miles of underground wires than any city in the Union. This mileage may be summed up as follows:

	Miles.
Bankers & Merchants' Telegraph Company	400
Postal Telegraph Company	180
Chicago Telephone Company	28
Western Indiana Railroad	50
City & Fire Alarm Telegraph	60
Total	718

In addition to this, the Western Union Telegraph Company will soon place 500 miles and the Baltimore & Ohio Company approximately 250 miles, making a grand total, in the near future, of 1,468 miles of underground wires, besides the growing additions of the coming years.

Mr. W. M. Callender, son of the inventor, and his representative, is in Chicago in the interest of the Callender wire, which has an excellent insulating covering, and also a fire-proof outside coating. He is endeavoring, with a fair show of success, to get into the market with a specialty of electric light wires at a price which will go far toward success.

The last remaining Chicago bucket shop is making a very determined fight for quotations, and arguments were heard Jan. 24, on behalf of the bucket shop, to have the officers of the Baltimore & Ohio Telegraph Company and of the Board of Trade attached for contempt for the alleged violation of an injunction restraining the two corporations named from depriving the Public Stock Exchange of market quotations. Among the witnesses examined were F. H. Tubbs, Division Superintendent of the Western Union Telegraph Company; C. S. Wood, Superintendent of the Gold and Stock Telegraph Company; General Thompson, of counsel for the Western Union; W. McCulloch, Manager of the Bankers and Merchants'; A. B. McCoy, Manager of the Western Union Company, and F. Ketcham and F. H. Lithgow, telegraph operators. The case was to have another hearing Jan. 30.

The business of the Nebraska Telephone Company has

had a steady growth during the last year. Two new exchanges were built, Wilber and Wahoo, the former with 33 and the latter with 40 subscribers. Twelve miles of toll line were put up between Lincoln and Waverly.

The main portion of the company's lines in Lincoln were rebuilt at an expense of about two thousand dollars. Forty-five, fifty and sixty-feet poles were used in this rebuilding, and the "tower" system of running wires into the office was abandoned, office wire cables from switchboards to a very neatly arranged and very compact box on the office pole being substituted. Six hundred wires can be brought from different directions and easily provided for on this pole, thence to office through the cables. One decided advantage in this arrangement will manifest itself, in case of fires, in central office. The central office in Lincoln was also remodeled and enlarged. The service there is first-class in every respect—304 subscribers in a population of about 16,000. The office is under charge of Mr. A. P. Fair, a very efficient manager. Mr. Fair is also circuit manager of the extra-territorial lines of the South Platte Division. Mr. Fair entered the service three years ago as lineman, under the old Exchange Company at Lincoln, and has risen to his present responsible position solely by his own industry and fitness for the place. The company also rebuilt their lines between Omaha and the Transfer Grounds and Council Bluffs, on the east side of the Missouri River. They have now fifteen first-class wires to the transfer, and seven from there to Council Bluffs. They have also erected a line of three wires from Omaha to the new stock yards, a distance of three and a half miles south, and another line to the fertilizing works, three miles. The Fremont Exchange was partially rebuilt during the year. The property of the Nebraska Company is now all in first-class shape except Grand Island exchange, which will be rebuilt in the spring. On the 31st inst. (to-day) they pay their seventh quarterly cash dividend of two (2) per cent. The company commenced business Oct. 1, 1882, and its present satisfactory condition is mainly due to its very efficient General Manager Mr. Flemon Drake.

The Rocky Mountain Bell Telephone Co., on Jan. 1, 1885, had 1,460 subscribers and 22 exchanges; having gained 452 subscribers and built 7 new exchanges during 1884. The company is now operating about 500 miles of toll and extra-territorial lines.

The Sperry Electric Light Co. have increased their plant in the Gault House to twenty-eight, and have recently fitted up the West Division street car company's works with their apparatus.

The Western Electric Company, at a meeting of the Executive Committee, held on the 23d inst., declared a quarterly dividend of one and one-half per cent. on the stock outstanding. At the annual meeting of the company General Anson Stager was re-elected to the office of president, but immediately resigned, and Mr. Wm. S. Smoot was then elected president. Suitable resolutions were passed on the retirement of General Stager, who has been the president of the company since its organization. Mr. Smoot is an Eastern man, but will probably now reside in Chicago. The Western Electric Company sold last year 4,246 miles of conductors of Patterson cable; 1,561 miles of this was for underground use; 2,617 miles for overhead use, and 68 miles was submarine cable. This is double the amount sold in 1883, the sales for that year amounting to 2,006 miles. In 1882, 1,100 miles were sold.

THE TELEGRAPH.

Military Telegraph in Spain.—The military telegraph system of Spain is to be reorganized and extended, and the latest improvements adopted.

The Commercial Cables.—It is announced that the second cable of the Mackay-Bennett Commercial Cable Company has been duplexed, which doubles its former facilities. The officials of the company say that the Havre section of the line will be laid next month.

A New Battery.—In the battery made by M. de Sainte Marie, the positive pole is of lead, surrounded by chlorate of lead, and the negative pole of zinc, while the liquid contains chloride of lead, presumably for diminishing the resistance. Under the influence of the electric current, the chlorate of lead is reduced to metallic lead, which is deposited in the form of sponge.

Perforating an Operator.—A telegraph operator in Washington Territory is liable to get his skin filled with cold bullets if he isn't careful. At Tacoma, W. T., the other day, a cowboy sent a message by telegraph, and, having occasion to return a few hours later, saw his telegram lying on the table. He immediately got his Western blood up, thinking that the message had not been sent, and proceeded to shoot holes through the operator. After the young man had had six or eight good-sized bullets lodged in different parts of his body, he succeeded in explaining to the hot-headed bovine chaser how a message is sent. It is due to the cowboy to say that he apologized for being so hasty.

THE TELEPHONE.

Evansville, Ind.—This exchange, by last reports, is working up to its full capacity of 600 subscribers, and averages about 4,000 calls a day. The manager and superintendent is Mr. J. S. Craig.

Numbers Instead of Names.—Up at Niagara Falls, the telephone subscribers are learning slowly to call up by numbers instead of names. The process is said to be trying, but the local papers are all telling them how to do it.

To Deal in Telephone Stocks.—W. C. Dewey & Co. succeed F. W. Brown & Co. as bankers and brokers at No. 20 Devonshire street, Boston, Mr. Brown retiring to engage in a private enterprise. Mr. Dewey was formerly cashier of the national bank at Palmer and treasurer of the Palmer Wire Company. The new firm will make telephone stocks a specialty.

The Servant of All.—A dispatch from Indianapolis, of Jan. 20, says, on account of the exclusive contract between the Western Union Company and the Bell Company, the telephone exchange in this city refused a telephone connection to the Baltimore & Ohio Telegraph Company. A suit was brought to compel the exchange to give the service, and it has been decided in favor of the Baltimore & Ohio Company.

The "Locophone."—The latest mechanical contrivance for dispatch and safety in the running of railway trains is the "locophone," which has been constructed by Frank B. Taylor and is now being tested on the New York & New Haven road. The apparatus resembles the telephone and is designed to place each engineer on the road, while the trains are moving at the highest speed, in instantaneous speaking communication with the superintendent or train dispatchers. By its means all the engineers on the road receive the message at the same moment. The circuit is completed through the rails.

Rates Too High.—A dispatch of the 27th from Schenectady, N. Y., says: "There is a telephone strike in Schenectady and 55 of the 115 subscribers to the telephone company have signed a petition which was presented to Manager A. B. Uline, at Albany today, asking for a reduction of the telephone rates on the ground that the number of subscribers in the city was so small that telephones were comparatively valueless, that the messenger service was cheaper and more satisfactory, and that out-of-town telegraph rates were cheaper than telephone rates. Mr. Uline, in answering the petition, said that there was so little profit in the system that he could not make a lower rate. Nearly all of the petitioners have agreed to take out their telephones.

The Sudden Falling of "Drops."—Some of our correspondents have been discussing this subject. Another case is reported in the following dispatch of January 17, from Albany, N. Y.: At an early hour this morning the employés of the Commercial Telephone Company's central office were startled by every drop in the office falling at the same instant. No damage was done, and the frightened men rearranged the drops for business. At first no one could account for the phenomenon. Manager Euline finally reached the conclusion that an electric current from the earth was responsible for the occurrence; in other words, the elements of an earthquake had been at work, but the electricity had escaped from the ground without producing any great shock. Similar instances have occurred recently in New Hampshire and in Spain. The effect upon the telephone wires is the same as if they were struck by lightning. This is the first experience of the kind by the Albany office.

He Must Have a Telephone.—The Nebraska Supreme Court has just rendered an important decision in the case of a man who was refused the privilege of becoming a subscriber to the Nebraska Telephone Company, although he offered to comply with all the requirements usually demanded of subscribers. He brought a mandamus suit to compel the company to permit him to have the use of the telephone upon the usual conditions. The Supreme Court, in deciding in his favor, held the telephone company to be a public servant as a common carrier, and as such it must treat all persons alike, and that where no good reason can be assigned for refusal to furnish a telephone instrument to a person who offers to comply with the regulations, a writ of mandamus will issue to compel any telephone company to supply such person with the necessary instruments. This decision defines the position of incorporated telephone companies to be virtually the same as that of a telegraph company or any other corporation for the performance of services for the public.

Invited to "Cut In."—The Sandy Hill (N. Y.) *Herald* says: Messrs. Haskins & Wyman, two active young men of Granville, have interested themselves in a telephone project, called the Molecular Telephone Company, with the right to construct lines in Washington and Warren counties. They have erected wires in Granville village and all the neighboring towns, with perfect satisfaction to the patrons. Rates are much below the schedule charged by the line in operation in this locality, and it is said to give better results. We learn that it is proposed to form a company to extend the lines of the Molecular from Granville west to this village (as well as north and south), with the view of connecting with Warren County. Several of our interior towns are yet "in the wilderness," cut off from all communication with the outside world—railroad, telegraph and telephone—with the exception of the antiquated, lumbering stages. Here is an opportunity—the cheapest yet offered—to hitch on to the car of progress, if they only will do it. Messrs. Haskins & Wyman, Granville, will promptly answer all communications on the subject.

THE ELECTRIC LIGHT.

Montreal.—The Royal Electric Light Company had 195 customers early this month.

Lyceum Theatre, New York.—This new theatre is being entirely equipped by the Edison Isolated Electric Light Company.

The Gas Was Turned On.—Last week two people died in a hotel on Canal street from suffocation by gas, and an immigrant girl, who blew out the gas in her bedroom on retiring, was found almost beyond recovery next morning. The incidents of this nature, occurring so frequently, illustrate vividly the dangers of electric lighting.

The Civil Engineers' Meeting in New York.—The annual meeting of the American Institute of Civil Engineers was held at the house of the society, 127 East Twenty-third street, last week. The engineers visited several interesting places in this city and Brooklyn, including the immense electric lighting station of the United States Company on Stanton street.

The Universal Electric Light.—Two Berlin skating rinks are lighted by the Brush system. The new female hospital, also in the same city, has 96 incandescent lamps. A petition presented to the Paris Municipal Council requests the substitution of electric lights for gas in the public schools of that city. The number of electric lamps in the Opera-House, Paris, has been increased to 32 Edison and 6 Cance arc lamps.

Annual Meeting of the Brush Company.—On the 19th inst., the annual meeting of the Brush Electric Company was held at Cleveland, when the following directors were elected: G. W. Stockly, J. J. Tracy, C. F. Brush, Mrs. J. W. Cary, M. D. Leggett, J. Potter, and Wm. F. Swift. After the stockholders meeting, the Board of Directors met and re-elected the following officers: G. W. Stockly, President; J. J. Tracy, Vice-President; Wm. F. Swift, Secretary; and J. Potter, Treasurer. A dividend was declared of one per cent. on the capital stock of the company, payable Feb. 1 to all stockholders of record of Jan. 25.

St. Joseph, Mo.—The subjoined is an extract from the annual report of the local Board of Trade: "The Electric Light and Power Company has made many marked improvements during the past year. The company is composed of local capitalists, and the best evidence that they are satisfied with the investment is the fact that when the capital stock was recently increased from twenty-five to fifty thousand dollars, the old stockholders took the entire new issue, not a single share being thrown upon the market. The company has seven miles of wire. The Thomson-Houston electric machine is used. Its capacity is ninety-five lights, all of which are burning and subscribed for."

Springfield, Mass.—According to a dispatch of Jan. 25, a contract has been closed between Hon. H. S. Hyde and his associates in the Springfield Electric Light Company, using the New England Weston electric system, and Mr. Goff, president American Electric and Illuminating Company, by which the Weston system is to be entirely abandoned and a full 100-light plant of the American system is to be immediately installed. Land for the new building has been selected, and the new station is to be erected immediately, with facilities for 200 lights and room for an incandescent plant whenever the company concludes to introduce it. The local reasons for the failure of the old plant are not stated.

The Edison Lamps in Paris.—The Paris Edison Company has put down a combined arc and incandescent lighting plant at the Magazins du Gagne-petit, Paris. The incandescent system is reserved for rooms of moderate height, while the Cance arc lamps are employed in the larger spaces. All the dynamos are Edison's—two 200-lamp and two 100-lamp machines. The present lighting is effected by 400 Edison and 10 Cance lamps; but 300 more lamps are shortly to be put up and two more dynamos. The Edison lamps are arranged in separate circuits for illuminating respectively the ground floor, the entresol, and the four floors above, while another circuit serves the day lamps, and still another those on the staircase.

The London Stock Exchange.—The lighting of this new building has been carried out by Messrs. Woodhouse & Rawson, who have made the most of the space at their command, so far as the machine room is concerned. Two field boilers supply steam to two of Willans' high-speed compound engines, which drive two Elwell-Parker dynamos. A third dynamo is held in reserve and can be driven by either engine. If necessary, either of the boilers can supply both engines, or, at a push, one engine will drive the dynamos, so that the machinery is really in duplicate, thus obviating the danger of a total break-down. The main hall of the new building, which is octagonal in shape, carries a dome 70 ft. in diameter. On the cornices, at the spring of the dome, specially designed wrought-iron standards are placed. These standards carry Woodhouse & Rawson incandescent lamps of 50 candle-power. Beside the standards there are a few similar single lamps. Altogether seventy-six lamps light the hall, while in the settling room below are sixty-six lamps of 20 candle-power.

MISCELLANEOUS NOTES.

Instrumental Record of Earthquake Shocks.—A telegram from Naples states that the new instruments at the observatory at Velletri registered the oscillations caused by the earthquakes of Dec. 28 and Jan. 3, and that no less than 200 shocks took place.

The Franklin Institute.—A resolution was adopted at the annual meeting of the Institute on the 22d, instructing the officers of the Institute to take steps to obtain from Congress reimbursements for the outlay made by the Institute in displaying the government exhibit.

Planté Accumulators.—M. Planté has made some accumulators in which the lead plates assume a horizontal position, having a contact piece turned up at right angles. With this arrangement there is no difficulty in connection with rolling, nor with the bending and coming into contact.

Savants at the Sorbonne.—A congress of scientific societies is to be held at the Sorbonne, Paris. Among the physical subjects to be discussed are: "Researches on the presence of watery vapor in the air by astronomical and spectroscopic observations," and "What is the utility of magnetic and electric observations with reference to weather prediction."

Institute of Technology, Boston.—A new society has been formed by the mechanical and electrical engineers of the Institute. It is for social purposes, is non-secret, and holds monthly meetings. The officers are: President, David Rice; Vice-President, J. K. Burgess; Secretary, Charles E. Richardson; Treasurer, Richard P. Borden; Chaplain, William M. Taylor.

Parod's Accumulator.—In the accumulator of M. Parod, the plates, instead of being simply composed of lead sheets, like those of Planté, contain a copper core, hermetically inclosed in a leaden cover, which constitutes the secondary plate proper, and which alone comes in contact with the exciting liquid. In the middle of this core, which is a good conductor, the primary current unites, simultaneously, all the secondary plates, every portion of which develops an equal electro-galvanic action. The absorption of the primary current is therefore excessively rapid and regular and the formation uniform. These secondary plates with conducting core, which are capable of any form and arrangement, are contained in a cell of ebonite or other similar material, divided into two parts by a porous diaphragm, in such a manner as to avoid the oxidation of the electrodes and the transposition of the salts.—*Il Giorno, Rivista dell' Elettricità.*

APPLICATIONS OF POWER.

Electric Motors in Paris.—At the Magazins du Louvre, Paris, the Compagnie Electrique has installed a No. 5 generator and a No. 5 motor for driving sewing machines, also a No. 3 motor for driving air-pumps. At the branch establishment a generator and two motors have been placed for running sewing machines. The work of the motors is said to be entirely satisfactory.

The Knight-Bentley System in Cleveland.—The electric motor has come to stay. We learn that the East Cleveland Street Railway Company, of this city, are completing arrangements for running the cars of the Euclid avenue, Cedar avenue and Garden street lines with electricity, on the Knight-Bentley system. For the present the new system will be applied to that portion of the lines running east of their respective stables. They will probably put up a new building at the Cedar avenue stables for engines, boilers and dynamos. The trial of their experimental car on the Garden street line during the winter months seems to have been fairly satisfactory. It is expected to have the new plant in operation inside of three months.—*Iron Trade Review.*

The Cleveland Experiments.—Mr. E. M. Bentley, of Cleveland, Ohio, of the Bentley-Knight Electric Railroad, in operation in that city, says that the recent severe snow-storm in the West has tested the electric railroad system very thoroughly. It had been feared by some that a hard snow-storm would interrupt travel. As to that he says: "Last Friday the conditions could not have been more unfavorable. The snow was deep and wet, covering track and conduit to a depth of several inches, but the first car ran out over the road as if it were a dry day in midsummer, plowing its way through the snow without the slightest difficulty, and though snow and sleet fell all day there was no interruption or delay. Nor did we experience any loss of current by leakage, though in our system we employ a higher electromotive force than has heretofore been thought feasible. This is the first time an electric railway has been tested under severe conditions, and the result is very gratifying."

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 51½, a 52½; B. &. M., b 3½, a 7; Mutual Union, b 13, a 16; Postal stock, b 1½, a 3; Postal sixes, b 26¼, a 27⅝; Western Union, b 57⅛, a 58.

Telephone.—Am. Bell, b 230, a 231; Erie, b 19¾; New England, b 31½, a 32.

The Boston *Herald* of Jan. 27 says: "Telephone stocks were well supported until mid-afternoon, when the announcement was made that the American Bell Company's patent in Canada had been declared void. This was too much for the price, and it fell to 230, a decline of 4½ points. The decision was by the Minister of Agriculture, from whom there is no appeal. The Bell Company has some 36,000 instruments rented in Canada. The decision is of considerable moment to Canadian companies using and preparing to use other instruments. As regards Bell stock, the idea obtains that the chief events that might be expected to boom the stock are now matters of history; that future rights will not have the value of those past, and that henceforth the company's business must be a matter of conservative growth. New England telephone, which had risen from 31 Saturday to 32½ this morning, fell back to 31½. Erie was steady at 19¾."

Electric Light.—Am. Elec. Co., b 2¾, a 2.90; Am. Elec., pref., b 8½, a 9; Edison, b 55.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED JAN. 13, 1885.

Apparatus for Distributing Electricity; O. Gassett, Boston, Mass..... 310,664

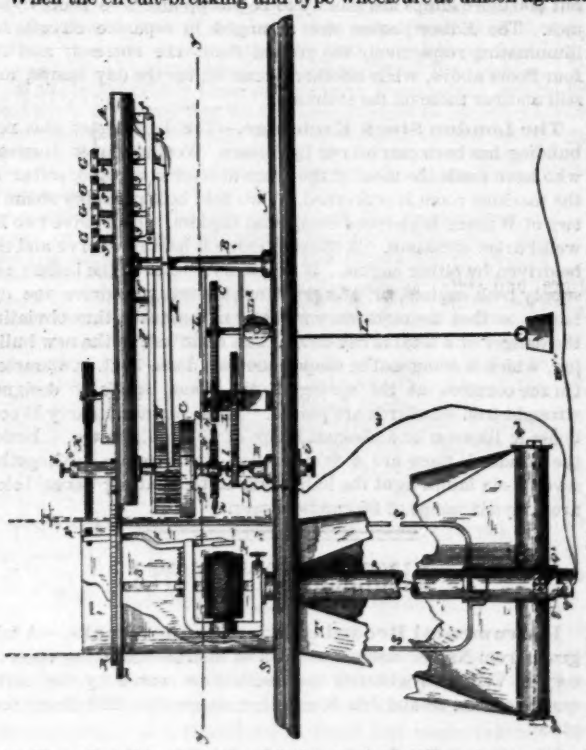
In an apparatus for distribution of electricity he employs a mechanical motor and electric generator actuated thereby, combined with an electro-magnet controlling the application of power to the said motor and circuit for the said generator and instruments operated therein and switches controlling the circuit of the said instruments and the circuit of the controlling magnet.

Apparatus for the Distribution of Electricity; O. Gassett, Boston, Mass..... 310,665

Consists of comprehensive improvements upon his two former patents.

Printing Telegraph; G. M. Hathaway, New York, N. Y., Assignor to Hathaway's Printing Telegraph and Telephone Company..... 310,587

When the circuit-breaking and type wheels are at unison against



pin *E'*, and at this time the friction-contact rollers bear against makes or conducting portions of the break-wheel, a key is depressed and a metallic pin *E* forced down through the plate *D*, an arm, being released, flies around and strikes the depressed metallic pin *E*, and the type-wheel is arrested with that letter or character opposite the printing-pad which is represented by the depressed pin. At this moment the main circuit is closed through the break-wheel, and the circuit of supplementary battery *X'* is closed through the printing-magnet to the line, because electrical connection is now made from post N^8 through extension *d'*, plate *D*, the depressed pin *E*, which the arm forces in contact with said plate, through said arm and the shaft *I*, to the break-wheel and spring-arm, supported by post, and which has a roller on a make of said break-wheel. The printing-magnet is thus energized and operates its armature-lever to force the paper *T* against the letter of the type-wheel when opposite the printing-pad.

Brush Holder for Dynamo-Electric Machines; H. R. Boissier, New York, N. Y..... 310,780

The brush holder is made as a frame with open sides, within which a follower is arranged to travel, it being adapted to press and hold the brush upon the bottom of the frame. Upon the sides of the follower two projections rise, in which are pivoted a rod carrying a cam or eccentric shaped on its two sides and lower end as a parallelogram, while the upper end is formed into a curve, such as the one shown, or a similar one. Upon the under side of the upper part of the brush holder is a spring. The rod upon which the eccentric is mounted is prolonged beyond the carrier, and terminates in a knob, preferably rubber-coated or otherwise insulated.

Cable or Electric Railway Yoke or Frame; Chester Bullock, New York..... 310,558

The tube yokes consist of a cast base having vertical and inclined wrought braces extending therefrom to a horizontal plate, and a diagonal brace extending downward and outward from each slot-iron to the inclined braces. The tube is constructed from matching tiles.

Combined Annunciator and Spring-Jack; L. Townsend, Evansville, Ind..... 310,750

He has a broad claim and sub-claims upon an annunciator electro-magnet formed with a hollow core, which contains a spring-jack.

Dynamo-Electric Machine; E. Weston, Newark, N. J., Assignor to United States Electric Light Company, N. Y..... 310,762

Disturbances are liable to occur from any momentary decrease of the working resistance, and the system is, so to speak, in a state of unstable equilibrium. This difficulty is not easily remedied by applying a current-regulator to the dynamo; he has found, however, that the difficulty is entirely overcome by so constructing the field-magnets that they do not respond readily to variations in the current exciting them, but require more or less time for changing their intensity.

The variations of resistance are generally momentary. He makes the field-magnets sufficiently sluggish in response to changes of current to allow such momentary disturbances to subside before any injurious reaction upon the intensity of the field takes place. This sluggishness or lack of sensitiveness of the field may be secured by increasing the mass of iron in the cores of the field-magnets, or by constructing them of hard iron, or in other ways which will readily suggest themselves to persons familiar with the construction of electro-magnets.

Electric Arc Lamp; S. H. Short, Denver, Col..... 310,736

A mechanism whereby the carbon points are allowed to move forward by brief and rapid advances through a certain adjustable distance, and then are stopped, the movement being made in such rapid succession that there is no appreciable change in the light.

Electric Arc Lamp; S. G. Woolley, Indianapolis, Ind., Assignor to the Ohio Power & Light Co., Dayton, O..... 310,630

Consists of a combination of a carbon-carrying pivoted swinging arm at an angle, and a weight, whereby as the carbon is consumed and the said arm approaches a more nearly horizontal position, the lost weight is compensated for.

Electric Arc Lamps; N. McCarty, Hoosac, N. Y., Assignor to J. B. Tibbits, of same place..... 310,837

Consists of the combination of the principal or feeding magnet, a differential magnet, and resistance coils between the main line and the negative carbon, outside the principal magnet, the circuit being through the iron of the armature of the differential magnet, and whereby said magnet and resistance coils maintain a balance between the outside circuit and the machine.

Electrode Dumb-Bell for Exercising Apparatus; J. H. Shaw, New York, N. Y..... 310,733

Consists of an electrode in the form of a dumb-bell, with an internal longitudinal chamber therein closed by a suitable stopper, and with an exterior electric conducting-surface adapted for contact with the hand grasping the dumb-bell and for connection with the flexible electric conductor of an electro-magnetic machine or battery.

Galvanic Battery; W. K. Kidder, New York, N. Y., Assignor to the Jerome Kidder Manufacturing Co., of same place..... 310,831

Consists of the combination, with the jar, its soft-rubber stopper, and the slide-rods arranged in vertical passages of the stopper for supporting the battery elements, of the metallic lining or linings arranged in said passages, to terminate above the lower surface of the stopper, thus allowing the rubber to close on the rods at that place.

Manufacture of Incandescents; E. Weston, Newark, N. J., Assignor to the United States Electric Light Company, New York, N. Y..... 310,761

The process consists in winding the blanks upon mandrels and baking to set or fix their shape, then packing them in a muffle with flaky plumbago and carbonizing them; the process serving as a means of carbonizing in almost any geometrical or irregular shape.

Means for Overcoming Statical Disturbances in Electricity; F. W. Jones, New York, N. Y..... 310,684

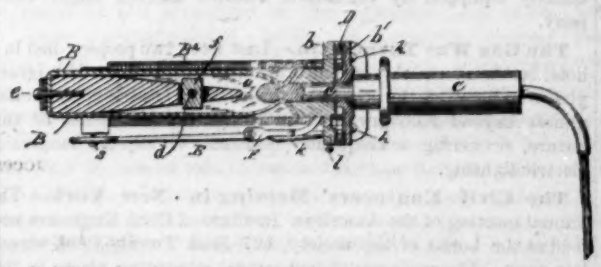
The aim of the invention is to superadd to the neutralizing effects due to the presence of the magnet the effect of a secondary current obtained from a secondary coil wound over, upon or in suitable inductive proximity to said magnet, said secondary coil being connected in a local closed circuit with means—such, for instance, as a magnet-coil—that is arranged to exert, by means of the secondary current flowing in it, an opposite effect upon the receiving apparatus to that which the so called "static charge and discharge current" tends to produce.

Quadruplex Telegraph; F. W. Jones, New York, N. Y..... 310,685

Consists in the combination, with above system, of a supplemental or clearing battery arranged to put to line a current of the opposite polarity to that of the normal charging-current, so as to assist in discharging the line at the time that said normal current or a reduced current of normal polarity is withdrawn, as will be hereinafter more fully described.

Combined Spring-Jack and Annunciator; L. Townsend and R. W. Moore, Evansville, Ind..... 310,749

The object of the invention is to so combine a spring-jack and annunciator for connecting and making calls upon a telephone



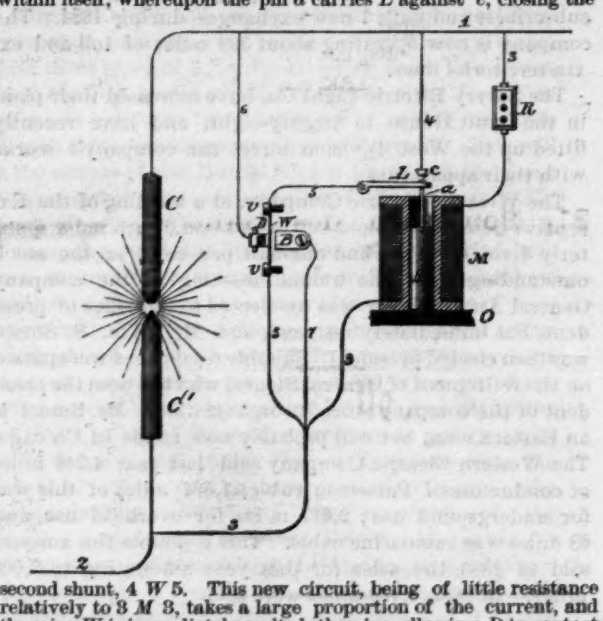
switch-board as to make both of them occupy only the space of one, and thereby save half of the space in the telephone switch-board, which is a result of great importance in telephone exchanges. The terminals of the circuit wire being connected to the seat *c* and binding-screw *d*, whenever a call is made, the electro-magnet B^2 is charged, the armature lever *E* is moved, and the annunciator drop *D* falls. The operator then places the plug *C* in the hole, and this, in throwing the springs *B B* away from the metal block connecting with binding-post *d*, cuts out the electro-magnet and allows the current to pass from the wire seat *c* to the plug *C*.

Regulator for Electric Arc Lamps; H. R. Boissier, New York, N. Y..... 310,781

Consists of the combination of a vibrating fly-gearing with the rack attached to the upper carbon carrier, and a lever notched at one end and normally in contact with the edge of the fly, the other end being weighted so as to keep the notched end in contact with the fly and prevent its oscillation except when released by the weighted end coming in contact with a stop attached to the frame of the regulator, both the said parts being contained entirely in the swinging frame.

Cut-Out for Electric Arc Lamps; H. R. Boissier, New York, N. Y..... 310,783

Upon the separation of the carbons to such a degree that a large resistance is offered to the current, or when one is consumed, so that there is no path whatever for the current through the light-giving portion, the current is entirely, or to a large degree, shunted through 3 *M* 3, causing *M* to raise *A* to a central position within itself, whereupon the pin *a* carries *L* against *c*, closing the



second shunt, 4 *W* 5. This new circuit, being of little resistance relatively to 3 *M* 3, takes a large proportion of the current, and the wire *W* is immediately melted thereby, allowing *D* to contact with *B*, closing the third shunt, 6 *D B* 7, which, being of practically no resistance compared to 3 *M* 3, takes most of the current, and then forms a permanent shunt around *C C'*, so that the remainder of the series is not affected by the failure of *C C'*.

Secondary Battery and Means for Transporting the Same; L. B. Rogers, New York, N. Y.... 310,724

Consists in building cells of storage batteries into vehicles of all kinds for land or water transportation—such as carts, wagons, railroad cars, canal boats, barges, river boats, ships and the like—so that the frames of the vehicles constitute, in whole or in part, the containing vessels of the batteries. The vehicles may be adapted for use solely as conveyers of electrical energy; but, owing to the weight of the battery-plates, electrodes or elements, it is preferred to make the lower part into a battery, and provide in addition accommodations for freight or passengers.

System of Electric Lighting; O. Gassett, Boston, Mass..... 310,663

The invention relates to a system of lighting by electricity, and is embodied in an apparatus in which each building to be lighted contains its own electric circuit and generator for electricity and a motor to operate the generator, while the power for actuating the motors of a large number of buildings or stations is distributed from a central station. The power is distributed by means of compressed air, there being at the main station a compressing engine and reservoir to retain a considerable quantity of compressed air, and the system also comprises small reservoirs at the different buildings, containing a sufficient amount of compressed air to actuate the motor for a considerable length of time without further supply from the main station.

System of Generating and of Regulating Electric Currents; E. Weston, Newark, N. J., Assignor to United States Electric Light Company, New York, N. Y..... 310,763

The regulating device consists of a variable resistance in the field circuit, the latter being independent of or derived from the main or working circuit. By varying the resistance to compensate for variations or fluctuations in the resistance of the main circuit the amount of current is permitted to flow through the field-circuit which is requisite for producing the normal current for running any number of devices in the main circuit, from the least to the greatest number for which the machine is designed.

Telephone; H. E. Waite, New York, N. Y., Assignor to C. F. Livermore, trustee, of same place..... 310,751

Consists in having the coil upon the end of the magnet farthest from the diaphragm.

Underground Housing and Insulation for Electric Conductors; E. C. Townsend, New York, N. Y..... 310,748

Consists in utilizing space in or immediately underneath sidewalks and street crossings in cities and towns.